Plants with increased activity of a Class 3 branching enzyme

Description

[001]   The present invention relates to plant cells and plants, which are genetically modified, wherein the genetic modification leads to an increase in the activity of a Class 3 vegetable branching enzyme in comparison with corresponding wild type plant cells or wild type plants that have not been genetically modified. Furthermore, the present invention relates to means and methods for the manufacture of such plant cells and plants. Plant cells and plants of this type synthesise a modified starch. The present invention therefore also relates to the starch synthesised by the plant cells and plants according to the invention as well as to methods for the manufacture of the starch and to the manufacture of starch derivatives of this modified starch.

[002]   With regard to the increasing importance currently attributed to vegetable constituents as renewable raw material sources, one of the tasks of biotechnological research is to endeavour to adapt these vegetable raw materials to suit the requirements of the processing industry. Furthermore, in order to enable regenerating raw materials to be used in as many areas of application as possible, it is necessary to achieve a large variety of materials.

[003]   Polysaccharide starch is made up of chemically uniform base components, the glucose molecules, but constitutes a complex mixture of different molecule forms, which exhibit differences with regard to the degree of polymerisation and branching, and therefore differ strongly from one another in their physical-chemical characteristics. Discrimination is made between amylose starch, an essentially unbranched polymer made from α-1,4-glycosidically linked glucose units, and the amylopectin starch, a branched polymer, in which the branches come about by the occurrence of additional α-1,6-glycosidic links. A further essential difference between amylose and amylopectin lies in the molecular weight. While amylose, depending on the origin of the starch, has a molecular weight of $5 \times 10^5 - 10^6$ Da, that of the amylopectin lies between 10^7 and 10^8 Da. The two macromolecules can be differentiated by their molecular

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weight and their different physical-chemical characteristics, which can most easily be made visible by their different iodine bonding characteristics.

[004]   Amylose has long been looked upon as a linear polymer, consisting of α-1,4-glycosidically linked α-D-glucose monomers. In more recent studies, however, the presence of α-1,6-glycosidic branching points (ca. 0.1%) has been shown (Hizukuri and Takagi, Carbohydr. Res. 134, (1984), 1-10; Takeda et al., Carbohydr. Res. 132, (1984), 83-92).

[005]   Amylopectin constitutes a complex mixture of differently branched glucose chains. In contrast to amylose, amylopectin is more strongly branched. According to textbook information (Voet and Voet, Biochemistry, John Wiley & Sons, 1990), on average, the α-1,6 branches occur every 24 to 30 glucose residues. This is equivalent to a degree of branching of ca. 3% - 4%. The figures for the degree of branching are variable and are dependent on the origin (e.g. plant species, plant type etc.) of the appropriate starch. In typical plants used for the industrial production of starch, such as maize, wheat or potato, for example, the synthesised starch consists of ca. 20% - 30% amylose starch and ca. 70% - 80% amylopectin starch.

[006]   The functional characteristics of the starch, along with the amylose/amylopectin ratio and the phosphate content, are strongly affected by the molecular weight, the pattern of the side chain distribution, the ion concentration, the lipid and protein content, the average grain size of the starch and the grain morphology of the starch etc. At the same time, by way of example, the solubility, the retrogradation behaviour, the water bonding capability, the film formation characteristics, the viscosity, the sticking characteristics, the freezing-thawing stability, the acid stability, the gelling strength etc. must be mentioned as important functional characteristics. The grain size of the starch can also be important for different applications.

[007]   Branching enzymes, which are also abbreviated by the designation "BE" (from Branching Enzyme; E.C. 2.4.1.18), catalyse the introduction of α-1,6 branches in α-1,4-glucans. Branching enzymes and the nucleic or amino acid sequences that characterise them are known from widely different organisms, such as bacteria, microbial fungi, mammals, algae and higher plants, for example. As only plants synthesise starch, while the above-mentioned non-vegetable

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organisms (e.g. bacteria, fungi and mammals) synthesise glycogen, the related branching enzymes, which are involved in the synthesis of the appropriate polymer, can also be sub-divided into glycogen branching enzymes and starch branching enzymes. Plants are therefore starch branching enzymes, which are often also referred to as Q-enzymes in older literature.

[008]   In all plant species that have been investigated up to now, the branching enzymes described can be associated with two different classes (Burton et al., 1995, Plant Journal 7, 3-15; Mizuno et al., 2001, Plant Cell Physiol. 42(4), 349-357). The association with these classes, sometimes designated in the literature with A or 2 respectively and B or 1 respectively, is based on the comparison of derived protein sequences.

[009]   As different nomenclatures have been used in the past for designating and classifying branching enzymes, Smith-White and Preiss (1994, Plant Molecular Biology Reporter 12, 67-71) (1994, Plant Molecular Biology Reporter 12, 67-71) have proposed a system for standardising this nomenclature, in which the association with the two classes of vegetable branching enzymes is also based on the comparison of derived protein sequences (Larsson et al., 1998, Plant Mol. Biol. 37, 505-511). According to this nomenclature, those vegetable branching enzymes, the amino acid sequence of which has a higher degree of identity with that of branching enzyme I of maize (GenBank Acc: D11081), is to be designated as a Class 1 branching enzyme, and those vegetable branching enzymes, the coding amino acid sequence of which has a higher degree of identity with that of branching enzyme II of maize (GenBank Acc: AF072725), is to be designated as a Class 2 branching enzyme. The designation of gene products, which are coding for branching enzymes, are, in accordance with the nomenclature of Smith-White and Preiss, to be incorporated in the already existing nomenclature by means of E.C. numbers. This results in the so-called GPN (Gene Product Number) Codes for the two classes, namely GPN 2.2.4.1.18:1 for Class 1 branching enzymes and GPN 2.2.4.18:2 for Class 2 branching enzymes.

[0010]   The following vegetable or starch branching enzymes therefore belong to Class 1 (GPN 2.2.1.18:1) according to the nomenclature proposed by Smith-White and Preiss (1994, Plant Molecular Biology Reporter 12, 67-71): BE I from *Aegilops tauschii* (GenBank Acc: AF525746), BE I from barley (GenBank Acc: AY304541), BE from tapioca (GenBank Acc:

X77012), BE I (frequently also described as BE 1) from rice (GenBank Acc: D11082, D10752, D10838), BE 3 from bean (GenBank Acc: AB029549), BE II from pea (GenBank Acc: X80010), BE from millet (GenBank Acc: AF169833), BE I from potato (GenBank Acc: Y08786, X69805), BE from wheat (GenBank Acc: Y12320, AF076679, AF002820) and BE I from maize (GenBank Acc: D11081, AAO20100, E03435, AY176762, U17897, AF072724). At the same time, the amino acid sequences for different Class 1 branching enzymes each have an identity of more than 60% with the amino acid sequence of branching enzyme I from maize (GenBank Acc: D11081).

[0011]   Branching enzymes, which belong to Class 2 (GPN 2.2.1.18:2) according to the nomenclature proposed by Smith-White and Preiss (1994, Plant Molecular Biology Reporter 12, 67-71) are, for example, BE IIa from *Aegilops tauschii* (GenBank Acc: AF338431, WO 9914314), BE2-1 and BE2-2 from *Arabidosis thaliana* (BE2-1 GenBank Acc: NM_129196 CAA04134; BE2-2 GenBank Acc: CAB82930, NM_120446), BE IIa and BE IIb from barley (BE IIa GenBank Acc: AF064560; BE IIb GenBank Acc: AF064561), BE II from sweet potato (GenBank Acc: AB071286), BE III and BE IV (frequently also described as BE 3 or BE 4 respectively) from rice (BE III GenBank Acc: D16201; BE IV GenBank Acc: AB023498), BE 1 from bean (GenBank Acc: AB029548), BE I from pea (GenBank Acc: X80009), BE IIb from millet (GenBank Acc: AY304540), BE II from potato (GenBank Acc: AJ000004, AJ011885, AJ011888, AJ011889, AJ011890), BE II or BE IIa from wheat (GenBank Acc: Y11282, AF286319, AF338432, U66376) and BE II, or BE IIb from maize (BE II GenBank Acc: AAA18571, T02981; BE IIb GenBank Acc: AF072725, L08065). At the same time, the amino acid sequences for different Class 2 branching enzymes each have an identity of more than 60% with the amino acid sequence of branching enzyme IIb from maize (GenBank Acc: AF072725).

[0012]   Vegetable or starch branching enzymes belong to the family of alpha-amylolytic enzymes (Svensson, 1994, Plant Molecular Biology 25, 141-157; Jespersen et al., 1991, Biochem J. 280, 51-55) and, with regard to the amino acid sequence, have four conserved domains (Baba et al., 1991, Biochem. Biophys. Res. Commun. 181(1), 87-94; Kuriki et al., 1996, J. of Protein Chemistry 15(3), 305-313).

[0013]   Structural predictions based on mathematical calculations derived from experimental

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data such as protein crystal structures (Pfam: http://hits.isb-sib.ch/cgi-bin/PFSCAN?) show that all previously known branching enzymes from higher plants have two domains: an alpha-amylase domain and an iso-amylase domain. Here, the iso-amylase domain lies closer to the N-terminus of the protein than the alpha-amylase domain.

[0014]   Plants are known, for example, which have a reduced activity of a Class 2 branching enzyme due to a mutation. These include the so-called "*amylose extender*" (*ae*) mutants from maize (Stindard et al., 1993, Plant Cell 5, 1555-1566; Boyer and Preiss, 1978, Biochem. Biophys. Res. Commun. 80, 169-175) and rice (Mizuno et al., 1993, J. Biol. Chem. 268, 19084-19091), as well as the "*rugosus*" (r) mutation in pea (Smith, 1988, Planta 175, 270-279; Bhattacharyya et al., 1990, Cell 60, 115-122). All these mutants are distinguished by the fact that they synthesise a starch, which has an increased amylose content in comparison with starches from corresponding plants, which do not have this mutation.

[0015]   Furthermore, genetically modified potato plants are described, in which the activity of a BE I (Class 1) branching enzyme (Kossmann et al., 1991, Mol Gen Genet 230, 39-44; Safford et al., 1998, Carbohydrate Polymers 35, 155-168), or the activity of a BEII (Class 2) branching enzyme (Jobling et al., 1999, The Plant Journal 18), or the activity of a BEI and BEII branching enzyme (Schwall et al., 2000, Nature Biotechnology 18, 551- 554, Jobling et al., 2003, Nature Biotechnology 21, 77-80) are reduced.

[0016]   Previously, it has been possible to associate all vegetable branching enzymes to one or both of the classes described above. Plant cells or plants, which have an increased activity of a branching enzyme, which cannot be associated with these classes, are unknown.

[0017]   The object of the present invention is therefore based on providing modified starches, new plant cells and/or plants, which synthesise such a modified starch, as well as methods for producing said plants.

[0018]   This problem is solved by the embodiments described in the claims.

[0019] The present invention therefore relates to genetically modified plant cells and plants, characterised in that the plant cells or plants have an increased activity of at least one Class 3 branching enzyme in comparison with corresponding wild type plant cells or wild type plants that have not been genetically modified.

[0020] A first aspect of the present invention relates to a plant cell or plant, which is genetically modified, wherein the genetic modification leads to an increase in the activity of at least one Class 3 branching enzyme in comparison with corresponding wild type plant cells or wild type plants that have not been genetically modified.

[0021] At the same time, the genetic modification can be any genetic modification, which leads to an increase in the activity of at least one Class 3 branching enzyme in comparison with corresponding wild type plant cells or wild type plants that have not been genetically modified.

[0022] In conjunction with the present invention, the term "wild type plant cell" means that the plant cells concerned were used as starting material for the manufacture of the plant cells according to the invention, i.e. their genetic information, apart from the introduced genetic modification, corresponds to that of a plant cell according to the invention.

[0023] In conjunction with the present invention, the term "wild type plant" means that the plants concerned were used as starting material for the manufacture of the plants according to the invention, i.e. their genetic information, apart from the introduced genetic modification, corresponds to that of a plant according to the invention.

[0024] In conjunction with the present invention, the term "corresponding" means that, in the comparison of several objects, the objects concerned that are compared with one another have been kept under the same conditions. In conjunction with the present invention, the term "corresponding" in conjunction with wild type plant cell or wild type plant means that the plant cells or plants, which are compared with one another, have been raised under the same cultivation conditions and that they have the same (cultivation) age.

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[0025]   The plant cells according to the invention have an increased activity of at least one Class 3 branching enzyme in comparison with corresponding wild type plant cells that have not been genetically modified.

[0026]   Here, within the framework of the present invention, the term "increased activity" means an increase in the expression of endogenous genes, which code Class 3 branching enzymes and/or an increase in the quantity of Class 3 branching enzyme protein in the cells and/or an increase in the enzymatic activity of Class 3 branching enzymes in the cells.

[0027]   The increase in the expression can, for example, be determined by measuring the quantity of transcripts coding Class 3 branching enzyme, e.g. using Northern blot analysis or RT-PCR. Here, an increase preferably means an increase in the amount of transcripts in comparison with corresponding cells that have not been genetically modified by at least 50%, in particular by at least 70%, preferably by at least 85% and particularly preferably by at least 100%.

[0028]   The increase in the amount of protein of a Class 3 branching enzyme, which results in an increased activity of this protein in the plant cells concerned, can, for example, be determined by immunological methods such as Western blot analysis, ELISA (Enzyme Linked Immuno Sorbent Assay) or RIA (Radio Immune Assay). Here, an increase preferably means an increase in the amount of Class 3 branching enzyme protein in comparison with corresponding cells that have not been genetically modified by at least 50%, in particular by at least 70%, preferably by at least 85% and particularly preferably by at least 100%.

[0029]   Within the framework of the present invention, the term "branching enzyme" (α-1,4-glucan: α-1,4-glucan 6-glycosyltransferase, E.C. 2.4.1.18) is understood to mean a protein, which catalyses a transglycosylation reaction, in which α-1,4 links of an α-1,4-glucan donor are hydrolysed and the thereby released α-1,4-glucan chains are transferred to an α-1,4-glucan acceptor chain and, in doing so, are transformed into α-1,6-links. In particular, within the framework of the present invention, the term "branching enzyme" is to be understood to mean a vegetable branching enzyme, i.e. a starch branching enzyme.

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[0030] The activity of a branching enzyme can be demonstrated, for example, with the help of native acrylamide gel electrophoresis. In doing so, proteins are first separated electrophoretically and, after incubation in buffers containing an activity, which synthesises linear α-1,4-glucan chains (e.g. starch phosphorylase a) and its substrate (e.g. glucose-6-phosphate), the corresponding gels are coloured with iodine (Kimihiko et al., 1980, Analytical Biochemistry 108, 16-24). Furthermore, branching enzymes in microbial organisms, such as the *E. coli* strain KV832 for example (Kiel et al., 1987 Mol. Gen. Genet 207: 294-301), which do not synthesise branched α-glucans, can be expressed. If an activity of a branching enzyme is introduced into the microbial organism due to the expression of a foreign gene in such strains (e.g. *E. coli* KV832), then the branching enzyme activity can be demonstrated by treating colonies of these organisms with iodine vapour, for example. Colonies, which synthesise linear α-1,4-glucans, turn blue in this test, while colonies, which synthesise branched glucans by expressing an additional enzymatic activity of a branching enzyme, turn reddish-brown after treating with iodine vapour. It is also possible to express proteins in phosphoglucomutase mutants of *E. coli* to identify a branching enzyme activity of appropriate proteins (Buettcher et al., 1999, Biochem. Biophys. Acta 1432, 406-412).

[0031] A further possibility of demonstrating branching enzyme activity of proteins is the use of a reaction stimulated by phosphorylase a and the subsequent separation of the products by means of thin film chromatography (Almstrupp et al., 2000, Analytical Biochemistry 286, 297-300). Branching enzyme activities can also be demonstrated with the help of the methods described in Guan and Preiss (1993, Plant Physiol. 102. 1269- 1273) and Kuriki et al. (1996, J. of Protein Chemistry 15, 305-313).

[0032] In conjunction with the present invention, the term "Class 3 branching enzyme" is to be understood as a branching enzyme, which has a higher degree of identity with the amino acid sequence specified in Seq ID NO 4 than with that of the branching enzyme BE I from maize (GenBank Acc: D11081) or with that of the branching enzyme BE IIb from maize (GenBank Acc: AF072725). Preferably, the Class 3 branching enzyme comes from starch-storing plants, particularly preferably from plant species of the genus *Solanum*, especially preferably from *Solanum tuberosum*.

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[0033]   In a further embodiment of the present invention, amino acid sequences coding Class 3 branching enzymes have an identity of at least 60% with the sequence specified in SEQ ID NO 4, in particular of at least 70%, preferably of at least 80% and particularly preferably of at least 90% and especially preferably of at least 95%.

[0034]   According to the invention, Class 3 branching enzymes have an iso-amylase domain (Pfam acc.: Pf02922) and an alpha-amylase domain (Pfam acc: Pf00128). According to the invention, the iso-amylase domain and the alpha-amylase domain in amino acid sequences coding branching enzymes are separated from one another by the presence of further amino acids, which do not belong to these two domains.

[0035]   Class 3 branching enzymes according to the invention are distinguished by the fact that the iso-amylase domain is separated from the alpha-amylase domain by a greater number of amino acids than the iso-amylase domain and the alpha-amylase domain of Class 1 and 2 branching enzymes.

[0036]   Class 3 branching enzymes according to the invention are preferably distinguished with regard to their amino acid sequence by the fact that they have at least 70, preferably at least 100, particularly preferably at least 130 and especially preferably at least 198 amino acids between the iso-amylase domain and the alpha-amylase domain. In a further embodiment of the present invention, in the case of an amino acid sequence coding a Class 3 branching enzyme, the C-terminal end of the iso-amylase domain is separated from the N-terminal beginning of the alpha-amylase domain by 70 to 198, preferably by 100 to 198, particularly preferably by 130 to 198 and especially particularly preferably by 150 to 198 amino acids.

[0037]   With the help of the Pfam database (Batemann et al., 2002, Nucleic Acids Research 30,   276-280;   accessible   via   http://www.sanger.ac.uk/Software/Pfam/, http://www.cgb.ki.se/Pfam/; http://pfam.jouy.inra.fr/ or http://pfam.wustl.edu/), it is possible for the person skilled in the art to determine whether amino acid sequences already have known domains (e.g. an iso-amylase domain and/or an alpha-amylase domain). Pfam is a database put

together by experts, which classifies amino acid sequences into so-called families. Here, the assignment of an amino acid sequence to a family is carried out on the basis of so-called domains, which are to be looked upon as functional and structural components of proteins. A domain is defined as a structural unit or a repeatedly occurring amino acid sequence unit, which can occur in proteins with widely different functions. Along with information relating to the amino acid sequence of known proteins, further knowledge (e.g. evidence of the enzymatic activity, crystal structure data) is also used for the assignment of a protein to a family. Each family is assigned a name and an "accession" number (e.g. Name: Isoamylase_N, acc: PF02922). A constituent part of each family in the Pfam database is, amongst other things, a so-called "seed alignment". The "seed alignment" contains the amino acid sequences of representative proteins of a family. Starting from "seed alignments", a so-called profile HMM ("profile Hidden Markov Model"; overview article in: Durbin et al., "Biological Sequence Analysis: Probabilistic Models of Proteins and Nucleic Acids", Cambridge University Press, 1998, ISBN 0-521-62041-4) is produced using the HMMER 2 software (freely available under http://hmmer.wustl.edu/). The HMMs produced have names and are stored in the Pfam database specifically for the correspondingly assigned domains. In contrast to classical, multiple "alignments" (e.g. produced using the Clustal W program or the Blossum62 algorithm), HMMs are based on a valid statistical theory (Bayes theory of conditional probability, Markoff chains) and enable an interrogation sequence (query) to be assigned to a family based on the use of position-specific evaluation matrices. This enables an assignment to be made even when there are considerable differences in the amino acid sequences between the interrogation sequence (Query) and a comparison sequence (e.g. amino acid sequence entry in a database).

[0038]   The domain structure of the amino acid sequence concerned can be determined by means of a comparison of the HMMs stored in the Pfam database with amino acid sequences, which are entered as a so-called interrogation sequence (query) (e.g. under http://hits.isb-sib.ch/cgi-bin/PFSCAN?).

[0039]   In conjunction with the present invention, the term "iso-amylase domain" is to be understood to mean a Pfam iso-amylase domain (acc: Pf02922). At the same time, the HMM describing this Pfam iso-amylase domain is to be produced with the HMMER 2 [2.3.1] software,

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starting from a "seed alignment", which contains the amino acid sequences shown in Table 1. In conjunction with the present invention, the "seed alignment" is produced by means of the ClustalW program (Thompson et al., Nucleic Acids Research 22 (1994), 4673-4680; see below). The following settings must be chosen to produce the appropriate HMMs: Build Method of HMM: hmmbuild –F HMM_ls, hmmcalibrate –seed 0 HMM_ls; Gathering cutoff: 2.3 2.3; Trusted cutoff: 2.3 2.2; Noise cutoff: 2.1 2.1). Further information for producing the HMM of the Pfam iso-amylase domain (acc: Pf02922) is given in Table 3.

[0040]   In conjunction with the present invention, the term "alpha-amylase domain" is to be understood to mean a Pfam alpha-amylase domain (acc: Pf00128). At the same time, the HMM describing this Pfam alpha-amylase domain is to be produced with the HMMER 2 [2.3.1] software, starting from a "seed alignment", which contains the amino acid sequences shown in Table 2. Here, the "seed alignment" is produced by means of HMM_simulated_annealing (http://www.psc.edu/general/software/packages/hmmer/manual/node11.html#SECTION0032100 0000000000000). The following settings must be chosen to produce the appropriate HMM: Build Method of HMM: hmmbuild –F HMM_ls, hmmcalibrate –seed 0 HMM_ls; Gathering cutoff: -82.0 –82.0; Trusted cutoff: -81.7 –81.7; Noise cutoff: -82.7 –82.7). Further information for producing the HMM of the Pfam alpha-amylase domain (acc: Pf00128) is given in Table 4.

[0041]   In conjunction with the present invention, the term "Class 3 branching enzyme gene" is to be understood to mean a nucleic acid molecule (cDNA, DNA), which codes a Class 3 branching enzyme, preferably a Class 3 branching enzyme from starch-storing plants, particularly preferably from plant species of the genus *Solanum*, especially preferably from *Solanum tuberosum*.

[0042]   A preferred embodiment of the present invention relates to a genetically modified plant cell according to the invention or a genetically modified plant according to the invention, wherein the genetic modification consists in the introduction of at least one foreign nucleic acid molecule into the genome of the plant cell or into the genome of the plant.

[0043]   In this context, the term "genetic modification" means the introduction of homologous

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and/or heterologous foreign nucleic acid molecules into the genome of a plant cell or into the genome of a plant, wherein said introduction of these molecules leads to an increase in the activity of a Class 3 branching enzyme.

[0044] The plant cells according to the invention or plants according to the invention are modified with regard to their genetic information by the introduction of a foreign nucleic acid molecule. The presence or the expression of the foreign nucleic acid molecule leads to a phenotypic change. Here, "phenotypic" change means preferably a measurable change of one or more functions of the cells. For example, the genetically modified plant cells according to the invention and the genetically modified plants according to the invention exhibit an increase in the activity of a Class 3 branching enzyme due to the presence or on the expression of the introduced nucleic acid molecule.

[0045] In conjunction with the present invention, the term "foreign nucleic acid molecule" is understood to mean such a molecule that either does not occur naturally in the corresponding wild type plant cells, or that does not occur naturally in the concrete spatial arrangement in wild type plant cells, or that is localised at a place in the genome of the wild type plant cell at which it does not occur naturally. Preferably, the foreign nucleic acid molecule is a recombinant molecule, which consists of different elements, the combination or specific spatial arrangement of which does not occur naturally in vegetable cells. In principle, the foreign nucleic acid molecule can be any nucleic acid molecule, which effects an increase in the activity of a Class 3 branching enzyme in the plant cell or plant.

[0046] In conjunction with the present invention, the term "genome" is to be understood to mean the totality of the genetic material present in a vegetable cell. It is known to the person skilled in the art that, as well as the cell nucleus, other compartments (e.g. plastids, mitochondrions) also contain genetic material.

[0047] In a further embodiment, the plant cells according to the invention and the plants according to the invention are characterised in that the foreign nucleic acid molecule codes a Class 3 branching enzyme, preferably a Class 3 branching enzyme from starch-storing plants,

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particularly preferably from plants of a species of the genus *Solanum*, especially preferably from *Solanum tuberosum*.

[0048] In a particularly preferred embodiment, the foreign nucleic acid molecule codes a Class 3 branching enzyme with the amino acid sequence specified in SEQ ID NO 4.

[0049] A large number of techniques are available for the introduction of DNA into a vegetable host cell. These techniques include the transformation of vegetable cells with T-DNA using *Agrobacterium tumefaciens* or *Agrobacterium rhizogenes* as the transformation medium, the fusion of protoplasts, injection, the electroporation of DNA, the introduction of DNA by means of the biolistic approach as well as other possibilities. The use of agrobacteria-mediated transformation of plant cells has been intensively investigated and adequately described in EP 120516; Hoekema, IN: The Binary Plant Vector System Offsetdrukkerij Kanters B.V., Alblasserdam (1985), Chapter V; Fraley et al., Crit. Rev. Plant Sci. 4, 1-46 and by An et al. EMBO J. 4, (1985), 277-287. For the transformation of potato, see Rocha-Sosa et al., EMBO J. 8, (1989), 29-33, for example.

[0050] The transformation of monocotyledonous plants by means of vectors based on agrobacterium transformation has also been described (Chan et al., Plant Mol. Biol. 22, (1993), 491-506; Hiei et al., Plant J. 6, (1994) 271-282; Deng et al, Science in China 33, (1990), 28-34; Wilmink et al., Plant Cell Reports 11, (1992), 76-80; May et al., Bio/Technology 13, (1995), 486-492; Conner and Domisse, Int. J. Plant Sci. 153 (1992), 550-555; Ritchie et al, Transgenic Res. 2, (1993), 252-265). An alternative system to the transformation of monocotyledonous plants is transformation by means of the biolistic approach (Wan and Lemaux, Plant Physiol. 104, (1994), 37-48; Vasil et al., Bio/Technology 11 (1993), 1553-1558; Ritala et al., Plant Mol. Biol. 24, (1994), 317-325; Spencer et al., Theor. Appl. Genet. 79, (1990), 625-631), protoplast transformation, electroporation of partially permeabilised cells and the introduction of DNA by means of glass fibres. In particular, the transformation of maize has been described in the literature many times (cf. e.g. WO95/06128, EP0513849, EP0465875, EP0292435; Fromm et al., Biotechnology 8, (1990), 833-844; Gordon-Kamm et al., Plant Cell 2, (1990), 603-618; Koziel et al., Biotechnology 11 (1993), 194-200; Moroc et al., Theor. Appl. Genet. 80, (1990), 721-726).

[0051]   The successful transformation of other types of cereal has also already been described, for example for barley (Wan and Lemaux, see above; Ritala et al., see above; Krens et al., Nature 296, (1982), 72-74) and for wheat (Nehra et al., Plant J. 5, (1994), 285-297). All the above methods are suitable within the framework of the present invention.

[0052]   Amongst other things, the plant cells according to the invention and the plants according to the invention can be differentiated from wild type plant cells and wild type plants respectively in that they contain a foreign nucleic acid molecule, which does not occur naturally in wild type plant cells or wild type plants, or in that such a molecule is present integrated at a place in the genome of the plant cell according to the invention or in the genome of the plant according to the invention at which it does not occur in wild type plant cells or wild type plants, i.e. in a different genomic environment. Furthermore, plant cells according to the invention and plants according to the invention of this type differ from wild type plant cells and wild type plants respectively in that they contain at least one copy of the foreign nucleic acid molecule stably integrated within their genome, possibly in addition to naturally occurring copies of such a molecule in the wild type plant cells or wild type plants. If the foreign nucleic acid molecule(s) introduced into the plant cells according to the invention or into the plants according to the invention is (are) additional copies of molecules already occurring naturally in the wild type plant cells or wild type plants respectively, then the plant cells according to the invention and the plants according to the invention can be differentiated from wild type plant cells or wild type plants respectively in particular in that this additional copy or these additional copies is (are) localised at places in the genome at which it does not occur (or they do not occur) in wild type plant cells or wild type plants. This can be verified, for example, with the help of a Southern Blot Analysis.

[0053]   Furthermore, the plant cells according to the invention and the plants according to the invention can preferably be differentiated from wild type plant cells or wild type plants respectively by at least one of the following characteristics: If the foreign nucleic acid module that has been introduced is heterologous with respect to the plant cell or plant, then the plant cells according to the invention or plants according to the invention have transcripts of the introduced nucleic acid molecules. These can be verified, for example, by Northern blot analysis or by RT-

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PCR (Reverse Transcription Polymerase Chain Reaction). Plant cells according to the invention and plants according to the invention, which express an antisense and/or an RNAi transcript, can be verified, for example, with the help of specific nucleic acid probes, which are complimentary to the RNA (occurring naturally in the plant cell), which is coding for the protein. Preferably, the plant cells according to the invention and the plants according to the invention contain a protein, which is coded by an introduced nucleic acid molecule. This can be demonstrated by immunological methods, for example, in particular by a Western Blot Analysis.

[0054] If the foreign nucleic acid module that has been introduced is homologous with respect to the plant cell or plant, the plant cells according to the invention or plants according to the invention can be differentiated from wild type plant cells or wild type plants respectively due to the additional expression of the introduced foreign nucleic acid molecule, for example. The plant cells according to the invention and the plants according to the invention preferably contain (sense and/or antisense) transcripts of the foreign nucleic acid molecules. This can be demonstrated by Northern blot analysis, for example, or with the help of so-called quantitative PCR.

[0055] In a special embodiment, the plant cells according to the invention and the plants according to the invention are transgenic plant cells or transgenic plants respectively

[0056] In a further embodiment, the present invention relates to plant cells according to the invention and plants according to the invention wherein the foreign nucleic acid molecule is chosen from the group consisting of

a) Nucleic acid molecules, which code a protein with the amino acid sequence given under Seq ID NO 4;

b) Nucleic acid molecules, which code a protein, the amino acid sequence of which has an identity of at least 50% with the amino acid sequence given under SEQ ID NO: 4;

c) Nucleic acid molecules, which include the nucleotide sequence shown under Seq ID NO 3 or a complimentary sequence;

d) Nucleic acid molecules, the nucleic acid sequence of which has an identity of at least 50% with the nucleic acid sequences described under a) or c);

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e) Nucleic acid molecules, which hybridise with at least one strand of the nucleic acid molecules described under a) or c) under stringent conditions;

f) Nucleic acid molecules, the nucleotide sequence of which deviates from the sequence of the nucleic acid molecules identified under a), b), c), d), e) or f) due to the degeneration of the genetic code; and

g) Nucleic acid molecules, which represent fragments, allelic variants and/or derivatives of the nucleic acid molecules identified under a), b), c), d), e) or f).

[0057]   The amino acid sequence specified in SEQ ID NO 4 codes a protein with the activity of a Class 3 branching enzyme from *Solanum tuberosum.*

[0058]   A plasmid was deposited with the Deutsche Sammlung von Mikroorganismen und Zellkulturen GmbH, Mascheroder Weg 1b, 38124 Braunschweig, Germany, in accordance with the Budapest Treaty on 15th September 2003 under the number DSM 15926. The amino acid sequence shown SEQ ID NO 4 can be derived from the coding region of the cDNA sequence integrated in plasmid DSM 15926 and codes for a Class 3 branching enzyme from *Solanum tuberosum.* The present invention relates to nucleic acid molecules, which code a protein with the enzymatic activity of a Class 3 branching enzyme, which includes the amino acid sequence, which is coded by the insertion in plasmid DSM 15926, wherein the coded protein has an identity of at least 70%, preferably of at least 80%, particularly preferably of at least 90% and especially preferably of 95% with the amino acid sequence, which can be derived from the insertion coding a Class 3 branching enzyme in DSM 15926.

[0059]   The proteins coded from the different varieties of nucleic acid molecules according to the invention have certain common characteristics. These can include, for example, biological activity, molecular weight, immunological reactivity, conformation, the presence of structural and/or functional domains etc, as well as physical characteristics such as, for example, the running behaviour in gel electrophoresis, chromatographic behaviour, sedimentation coefficients, solubility, spectroscopic characteristics, stability; optimum pH, optimum temperature etc.

[0060]   The molecular weight of the Class 3 branching enzyme from *Solanum tuberosum*

derived from the amino acid sequence shown under SEQ ID NO 4 is ca. 103 kDa. The derived molecular weight of a protein according to the invention therefore preferably lies in the range from 85 kDa to 120 kDa, preferably in the range from 95 kDa to 110 kDa and particularly preferably from ca. kDa 100 to 105 kDa.

[0061]   The nucleic acid sequence shown in SEQ ID NO 3 is a cDNA sequence, which includes the coding region for a Class 3 branching enzyme from *Solanum tuberosum.*

[0062]   The present invention therefore also relates to nucleic acid molecules, which code a Class 3 branching enzyme and the coding region of the nucleotide sequence shown under Seq ID NO 3 or a complimentary sequence, nucleic acid molecules, which include the coding region of the nucleotide sequence of the insertion contained in plasmid DSM 15926, and nucleic acid molecules, which have an identity of at least 70%, preferably of at least 80%, particularly preferably of at least 90% and especially preferably of at least 95% with the said nucleic acid molecules.

[0063]   With the help of the sequence information of the nucleic acid molecule according to the invention or with the help of the nucleic acid molecule according to the invention, it is now possible for the person skilled in the art to isolate homologous sequences from other plant species, preferably from starch-storing plants, preferably from plant species of the genus *Solanum*, particularly preferably from *Solanum tuberosum.* This can be carried out, for example, with the help of conventional methods such as the examination of cDNA or genomic banks with suitable hybridisation samples. The person skilled in the art knows that homologous sequences can also be isolated with the help of (degenerated) oligonucleotides and the use of PCR-based methods.

[0064]   The examination of databases, such as are made available, for example, by EMBL (http://www.ebi.ac.uk/Tools/index.htm) or NCBI (National Center for Biotechnology Information, http://www.ncbi.nlm.nih.gov/), can also be used for identifying homologous sequences, which code for a Class 3 branching enzyme. In this case, one or more sequences are specified as a so-called query. This query sequence is then compared by means of statistical

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computer programs with sequences, which are contained in the selected databases. Such database queries (e.g. blast or fasta searches) are known to the person skilled in the art and can be carried out by various providers. If such a database query is carried out, e.g. at the NCBI (National Center for Biotechnology Information, http://www.ncbi.nlm.nih.gov/), then the standard settings, which are specified for the particular comparison inquiry, should be used. For protein sequence comparisons (blastp), these are the following settings: Limit entrez = not activated; Filter = low complexity activated; Expect value = 10; word size = 3; Matrix = BLOSUM62; Gap costs: Existence = 11, Extension = 1.

[0065]   For nucleic acid sequence comparisons (blastn), the following parameters must be set: Limit entrez = not activated; Filter = low complexity activated; Expect value = 10; word size = 11.

[0066]   With such a database search, the sequences described in the present invention can be used as a query sequence in order to identify further nucleic acid molecules and/or proteins, which code a Class 3 branching enzyme.

[0067]   With the help of the described methods, it is also possible to identify and/or isolate nucleic acid molecules according to the invention, which hybridise with the sequence specified under SEQ ID NO: 3 and which code a Class 3 branching enzyme.

[0068]   Within the framework of the present invention, the term "hybridising" means hybridisation under conventional hybridisation conditions, preferably under stringent conditions such as, for example, are described in Sambrock et al., Molecular Cloning, A Laboratory Manual, 2nd Ed. (1989) Cold Spring Harbor Laboratory Press, Cold Spring Harbor, NY). Particularly preferably, "hybridising" means hybridisation under the following conditions:

[0069]   Hybridisation buffer: 2xSSC; 10xDenhardt solution (Ficoll 400+PEG+BSA; Ratio 1:1:1); 0.1% SDS; 5 mM EDTA; 50 mM Na_2HPO_4; 250 µg/ml herring sperm DNA; 50 µg/ml tRNA; or 25 M sodium phosphate buffer pH 7.2; 1 mM EDTA; 7% SDS

[0070]   Hybridisation temperature: T=65 to 68°C

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[0071]   Wash buffer: 0.2xSSC; 0.1% SDS

[0072]   Wash temperature: T=65 to 68°C.

[0073]   In principle, nucleic acid molecules, which hybridise with the nucleic acid molecules according to the invention, can originate from any plant species, which expresses an appropriate protein, preferably they originate from starch-storing plants, preferably from species of the genus *Solanum*, particularly preferably from *Solanum tuberosum*. Nucleic acid molecules, which hybridise with the molecules according to the invention, can, for example, be isolated from genomic or from cDNA libraries. The identification and isolation of nuclear acid molecules of this type can be carried out using the nucleic acid molecules according to the invention or parts of these molecules or the reverse complements of these molecules, e.g. by means of hybridisation according to standard methods (see, for example, Sambrook et al., 1989, Molecular Cloning, A Laboratory Manual, 2nd Ed. Cold Spring Harbor Laboratory Press, Cold Spring Harbor, NY) or by amplification using PCR.

[0074]   Nucleic acid molecules, which exactly or essentially have the nucleotide sequence specified under SEQ ID NO: 3, or parts of this sequence, can be used as hybridisation samples. The fragments used as hybridisation samples can also be synthetic fragments or oligonucleotides, which have been manufactured using established synthesising techniques and the sequence of which corresponds essentially with that of a nucleic acid molecule according to the invention. If genes have been identified and isolated, which hybridise with the nucleic acid sequences according to the invention, then a determination of this sequence and an analysis of the characteristics of the proteins coded by this sequence should be carried out in order to establish whether a Class 3 branching enzyme is involved. Homology comparisons on the level of the nucleic acid or amino acid sequence and a determination of the enzymatic activity are particularly suitable for this purpose. As described above, the activity of a Class 3 branching enzyme can take place by expression in E. coli strains, which themselves do not express an active branching enzyme (Kiel et al., 1987 Mol. Gen. Genet 207: 294-301); Guan et al., 1995, Proc. Natl. Acad. Sci. 92, 964-967)..

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[0075]   The molecules hybridising with the nucleic acid molecules according to the invention particularly include fragments, derivatives and allelic variants of the nucleic acid molecules described above, which code a Class 3 branching enzyme from plants, preferably from starch-storing plants, preferably from plant species of the genus *Solanum*, particularly preferably from *Solanum tuberosum*. In conjunction with the present invention, the term "derivative" means that the sequences of these molecules differ at one or more positions from the sequences of the nucleic acid molecules described above and have a high degree of identity with these sequences. Here, the deviation from the nucleic acid molecules described above can have come about, for example, due to deletion, addition, substitution, insertion or recombination.

[0076]   The proteins coded from the different derivatives of nucleic acid molecules according to the invention have certain common characteristics. These can include, for example, biological activity, substrate specificity, molecular weight, immunological reactivity, conformation, the presence of structural and/or functional domains etc, as well as physical characteristics such as, for example, the running behaviour in gel electrophoresis, chromatographic behaviour, sedimentation coefficients, solubility, spectroscopic characteristics, stability; optimum pH, optimum temperature etc.

[0077]   In conjunction with the present invention, the term "identity" means a sequence identity over the whole length of the coding region of at least 60%, in particular an identity of at least 70%, preferably greater than 80%, particularly preferably greater than 90% and especially of at least 95%. In conjunction with the present invention, the term "identity" is to be understood to mean the number of amino acids/nucleotides (identity) corresponding with other proteins/nucleic acids, expressed as a percentage. Identity is preferably determined by comparing the Seq. ID NO 4 or SEQ ID NO 3 with other proteins/nucleic acids with the help of computer programs. If sequences that are compared with one another have different lengths, the identity is to be determined in such a way that the number of amino acids, which have the shorter sequence in common with the longer sequence, determines the percentage quotient of the identity. Preferably, identity is determined by means of the computer program ClustalW, which is well known and available to the public (Thompson et al., Nucleic Acids Research 22 (1994), 4673-4680).

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ClustalW is made publicly available by Julie Thompson (Thompson@EMBL-Heidelberg.DE) and Toby Gibson (Gibson@EMBL-Heidelberg.DE), European Molecular Biology Laboratory, Meyerhofstrasse 1, D 69117 Heidelberg, Germany. ClustalW can also be downloaded from different Internet sites, including the IGBMC (Institut de Génétique et de Biologie Moléculaire et Cellulaire, B.P.163, 67404 Illkirch Cedex, France; ftp://ftp-igbmc.u-strasbg.fr/pub/) and the EBI (ftp://ftp.ebi.ac.uk/pub/software/) as well as from all mirrored Internet sites of the EBI (European Bioinformatics Institute, Wellcome Trust Genome Campus, Hinxton, Cambridge CB10 1SD, UK).

[0078] Preferably, Version 1.8 of the ClustalW computer program is used to determine the identity between proteins according to the invention and other proteins. In doing so, the following parameters must be set: KTUPLE=1, TOPDIAG=5, WINDOW=5, PAIRGAP=3, GAPOPEN=10, GAPEXTEND=0.05, GAPDIST=8, MAXDIV=40, MATRIX=GONNET, ENDGAPS(OFF), NOPGAP, NOHGAP.

[0079] Preferably, Version 1.8 of the ClustalW computer program is used to determine the identity between the nucleotide sequence of the nucleic acid molecules according to the invention, for example, and the nucleotide sequence of other nucleic acid molecules. In doing so, the following parameters must be set: KTUPLE=2, TOPDIAGS=4, PAIRGAP=5, DNAMATRIX:IUB, GAPOPEN=10, GAPEXT=5, MAXDIV=40, TRANSITIONS: unweighted.

[0080] Furthermore, identity means that functional and/or structural equivalence exists between the nucleic acid molecules concerned or the proteins coded by them. The nucleic acid molecules, which are homologous to the molecules described above and constitute derivatives of these molecules, are generally variations of these molecules, which constitute modifications, which execute the same biological function. At the same time, the variations can occur naturally, for example they can be sequences from other plant species, or they can be mutations, wherein these mutations may have occurred in a natural manner or have been introduced by objective mutagenesis. The variations can also be synthetically manufactured sequences. The allelic variants can be both naturally occurring variants and also synthetically manufactured variants or variants produced by recombinant DNA techniques. Nucleic acid molecules, which deviate from

nucleic acid molecules according to the invention due to degeneration of the genetic code, constitute a special form of derivatives.

[0081]   The nucleic acid molecules according to the invention can be any nucleic acid molecules, in particular DNA or RNA molecules, for example cDNA, genomic DNA, mRNA etc. They can be naturally occurring molecules or molecules manufactured by genetic or chemical synthesis methods. They can be single-stranded molecules, which either contain the coding or the non-coding strand, or double-stranded molecules.

[0082]   Furthermore, the present invention relates to nucleic acid molecules of at least 21, preferably more than 50 and particularly preferably more than 200 nucleotides length, which specifically hybridise with at least one nucleic acid molecule according to the invention. Here, specifically hybridise means that these molecules hybridise with nucleic acid molecules, which code a protein according to the invention, but not with nucleic acid molecules, which code other proteins.

[0083]   A further embodiment of the present invention relates to plant cells according to the invention and plants according to the invention wherein the foreign nucleic acid molecule is chosen from the group consisting of

a) T-DNA molecules, which lead to an increase in the expression of a Class 3 branching enzyme gene due to integration in the vegetable genome (T-DNA activation tagging);

b) DNA molecules, which contain transposons, which lead to an increase in the expression of a Class 3 branching enzyme gene due to integration in the vegetable genome (transposon activation tagging);

c) DNA molecules, which code a Class 3 branching enzyme and which are linked with regulatory sequences, which guarantee transcription in vegetable cells and lead to an increase in Class 3 branching enzyme activity in the cell.

d) Nucleic acid molecules introduced by means of in vivo mutagenesis, which lead to a mutation or an insertion of a heterologous sequence in at least one endogenous gene coding a Class 3 branching enzyme, wherein the mutation or insertion effects an increase in the expression of a gene coding a Class 3 branching enzyme.

[0084]   In conjunction with the present invention, plant cells according to the invention and plants according to the invention can also be manufactured by the use of so-called insertion mutagenesis (overview article: Thorneycroft et al., 2001, Journal of experimental Botany 52 (361), 1593-1601). In conjunction with the present invention, insertion mutagenesis is to be understood to mean particularly the insertion of transposons or so-called transfer DNA (T-DNA) into a gene or in the vicinity of a gene coding for a Class 3 branching enzyme, whereby as a result of which the activity of a Class 3 branching enzyme in the cell concerned is increased.

[0085]   The transposons can be both those that occur naturally in the cell (endogenous transposons) and also those that do not occur naturally in said cell but are introduced into the cell (heterologous transposons) by means of genetic engineering methods, such as transformation of the cell, for example. Changing the expression of genes by means of transposons is known to the person skilled in the art. An overview of the use of endogenous and heterologous transposons as tools in plant biotechnology is presented in Ramachandran and Sundaresan (2001, Plant Physiology and Biochemistry 39, 234-252).

[0086]   T-DNA insertion mutagenesis is based on the fact that certain sections (T-DNA) of Ti plasmids from *Agrobacterium* can integrate into the genome of vegetable cells. The place of integration in the vegetable chromosome is not defined, but can take place at any point. If the T-DNA integrates into a part of the chromosome or in the vicinity of a part of the chromosome, which constitutes a gene function, then this can lead to an increase in the gene expression and thus also to a change in the activity of a protein coded by the gene concerned. Here, the sequences inserted into the genome (in particular transposons or T-DNA) are distinguished by the fact that they contain sequences, which lead to an activation of regulatory sequences of a Class 3 branching enzyme gene ("activation tagging").

[0087]   Plant cells and plants according to the invention can be produced by means of the so-called "activation tagging" method (see, for example, Walden et al., Plant J. (1991), 281-288; Walden et al., Plant Mol. Biol. 26 (1994), 1521-1528). These methods are based on activating endogenous promoters by means of "enhancer" sequences, such as the enhancer of the 35S RNA promoter of the cauliflower mosaic virus, or the octopine synthase enhancer.

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[0088] In conjunction with the present invention, the term "T-DNA activation tagging" is to be understood to mean a T-DNA fragment, which contains "enhancer" sequences and which leads to an increase in the activity of at least one Class 3 branching enzyme by integration into the genome of a plant cell.

[0089] In conjunction with the present invention, the term "transposon activation tagging" is to be understood to mean a transposon, which contains "enhancer" sequences and which leads to an increase in the activity of at least one Class 3 branching enzyme by integration into the genome of a plant cell.

[0090] In a preferred embodiment, the DNA molecules according to the invention, which code a Class 3 branching enzyme, are linked with regulatory sequences, which guarantee transcription in vegetable cells and lead to an increase in Class 3 branching enzyme activity in the cell. In this case, the nucleic acid molecules according to the invention are present in "sense" orientation to the regulatory sequences.

[0091] For expressing nucleic acid molecules according to the invention, which code Class 3 branching enzymes, these are preferably linked with regulatory DNA sequences, which guarantee transcription in vegetable cells. In particular, these include promoters. In general, any promoter that is active in vegetable cells is eligible for expression. At the same time, the promoter can be chosen so that expression takes place constitutively or only in a certain tissue, at a certain stage of the plant development or at a time determined by external influences. The promoter can be homologous or heterologous both with respect to the plant and with respect to the nucleic acid molecule.

[0092] Suitable promoters are, for example, the promoter of the 35S RNA of the cauliflower mosaic virus and the ubiquitin promoter from maize for constitutive expression, the patatin promoter B33 (Rocha-Sosa et al., EMBO J. 8 (1989), 23-29) for tuber-specific expression in potatoes or a promoter, which only ensures expression in photosynthetically active tissues, e.g. the ST-LS1 promoter (Stockhaus et al., Proc. Natl. Acad. Sci. USA 84 (1987), 7943-7947;

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Stockhaus et al., EMBO J. 8 (1989), 2445-2451) or, for endosperm-specific expression of the HMG promoter from wheat, the USP promoter, the phaseolin promoter, promoters of zein genes from maize (Pedersen et al., Cell 29 (1982), 1015-1026; Quatroccio et al., Plant Mol. Biol. 15 (1990), 81-93), glutelin promoter (Leisy et al., Plant Mol. Biol. 14 (1990), 41-50; Zheng et al., Plant J. 4 (1993), 357-366; Yoshihara et al., FEBS Lett. 383 (1996), 213-218) or shrunken-1 promoter (Werr et al., EMBO J. 4 (1985), 1373-1380). However, promoters can also be used, which are only activated at a time determined by external influences (see for example WO 9307279). Promoters of heat-shock proteins, which allow simple induction, can be of particular interest here. Furthermore, seed-specific promoters can be used, such as the USP promoter from *Vicia faba*, which guarantees seed-specific expression in *Vicia faba* and other plants (Fiedler et al., Plant Mol. Biol. 22 (1993), 669-679; Bäumlein et al., Mol. Gen. Genet. 225 (1991), 459-467).

[0093] Furthermore, a termination sequence (polyadenylation signal) can be present, which is used for adding a poly-A tail to the transcript. A function in the stabilisation of the transcripts is ascribed to the poly-A tail. Elements of this type are described in the literature (cf. Gielen et al., EMBO J. 8 (1989), 23-29) and can be exchanged at will.

[0094] Furthermore, plant cells according to the invention and plants according to the invention can be manufactured by means of so-called "in situ activation". In this case, the introduced genetic modification effects a change in the regulatory sequences of endogenous Class 3 branching enzyme genes, which leads to an increased expression of Class 3 branching enzyme genes. Preferably, the activation of a Class 3 branching enzyme gene takes place by "in vivo" mutagenesis of a promoter or of "enhancer" sequences of an endogenous Class 3 branching enzyme gene. In doing so, a promoter or an "enhancer" sequence, for example, can be changed in such a way that the mutation produced leads to an increased expression of a Class 3 branching enzyme gene in plant cells according to the invention or plants according to the invention in comparison with the expression of a Class 3 branching enzyme gene in wild type plant cells or wild type plants. The mutation in a promoter or an "enhancer" sequence can also lead to Class 3 branching enzyme genes in plant cells according to the invention or plants according to the invention being expressed at a time at which they would not be expressed in wild type plant cells or wild type plants.

[0095] In so-called "in vivo mutagenesis", a hybrid RNA-DNA oligonucleotide ("Chimeroplast") is introduced into plant cells (Kipp, P.B. et al., Poster Session at the "5th International Congress of Plant Molecular Biology, 21st-27th September 1997, Singapore; R. A. Dixon and C.J. Arntzen, meeting report on "Metabolic Engineering in Transgenic Plants", Keystone Symposia, Copper Mountain, CO, USA, TIBTECH 15, (1997), 441-447; international patent application WO 9515972; Kren et al., Hepatology 25, (1997), 1462-1468; Cole-Strauss et al., Science 273, (1996), 1386-1389; Beetham et al., 1999, PNAS 96, 8774-8778).

[0096] A part of the DNA components of the RNA-DNA oligonucleotide is homologous to a nucleic acid sequence of an endogenous Class 3 branching enzyme gene, but, in comparison with the nucleic acid sequence of a Class 3 branching enzyme gene, it has a mutation or contains a heterologous region, which is surrounded by the homologous regions.

[0097] By base pairing of the homologous regions of the RNA-DNA oligonucleotide and the endogenous nucleic acid molecule followed by homologous recombination, the mutation or heterologous region contained in the DNA components of the RNA-DNA oligonucleotide can be transferred into the genome of a plant cell. This leads to an increase in the activity of one or more Class 3 branching enzymes.

[0098] All these methods are based on the introduction of a foreign nucleic acid molecule into the genome of a plant cell or plant and are therefore basically suitable for the manufacture of plant cells according to the invention and plants according to the invention.

[0099] Surprisingly, it has been found that plant cells according to the invention and plants according to the invention synthesise a modified starch in comparison with starch of corresponding wild type plant cells or wild type plants that have not been genetically modified.

[00100] The plant cells according to the invention and plants according to the invention synthesise a modified starch, which in its physical-chemical characteristics, in particular the amylose content or the amylose/amylopectin ratio, the degree of branching, the average chain

length, the side chain distribution, the viscosity behaviour, the gelling strength, the starch grain size and/or the starch grain morphology, is changed in comparison with the synthesised starch in wild type plant cells or wild type plants, so that this is better suited for special applications.

[00101]   The present invention therefore also includes plant cells according to the invention and plants according to the invention, which synthesise a modified starch.

[00102]   In conjunction with the present invention, the term "modified starch" means that the starch has changed physical-chemical characteristics compared with non-modified starch obtainable from corresponding wild type plant cells or wild type plants.

[00103]   In a preferred embodiment of the present invention, the modified starch is native starch.

[00104]   In conjunction with the present invention, the term "native starch" means that the starch is isolated from plants according to the invention, harvestable plant plants according to the invention or propagation material of plants according to the invention by methods known to the person skilled in the art.

[00105]   Furthermore, genetically modified plants, which contain the plant cells according to the invention, are also the subject matter of the invention. Plants of this type can be produced from plant cells according to the invention by regeneration.

[00106]   In principle, the plants according to the invention can be plants of any plant species, i.e. both monocotyledonous and dicotyledonous plants. Preferably they are useful plants, i.e. plants, which are cultivated by people for the purposes of food or for technical, in particular industrial purposes.

[00107]   In a further preferred embodiment, the plant according to the invention is a starch-storing plant.

[00108]   In a further preferred embodiment, the present invention relates to starch-storing

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plants according to the invention of the genus *Solanum*, in particular *Solanum tuberosum*.

[00109]   The term "starch-storing plants" includes all plants with starch-storing plant parts such as, for example, maize, rice, wheat, rye, oat, barley, cassava, potato, sago, mung bean, pea or sorghum. Preferred starch-storing plant parts are, for example, tubers, storage roots and grains containing an endosperm; tubers are particularly preferred; tubers of potato plants are especially preferred.

[00110]   In conjunction with the present invention, the term "potato plant" or "potato" means plant species of the genus *Solanum*, in particular tuber-producing species of the genus *Solanum* and especially *Solanum tuberosum*.

[00111]   The present invention also relates to propagation material of plants according to the invention containing a plant cell according to the invention.

[00112]   Here, the term "propagation material" includes those constituents of the plant that are suitable for producing offspring by vegetative or sexual means. Cuttings, callus cultures, rhizomes or tubers, for example, are suitable for vegetative propagation. Other propagation material includes, for example, fruits, seeds, seedlings, protoplasts, cell cultures, etc. Preferably, the propagation material is seeds and particularly preferably tubers.

[00113]   In a further embodiment, the present invention relates to harvestable plant parts of plants according to the invention such as fruits, storage roots, roots, blooms, buds, shoots or stems, preferably seeds or tubers, wherein these harvestable parts contain plant cells according to the invention.

[00114]   Furthermore, the present invention also relates to a method for the manufacture of a genetically modified plant according to the invention, wherein

a) a plant cell is genetically modified, whereby the genetic modification leads to an increase in the activity of a Class 3 vegetable branching enzyme in comparison with corresponding wild type plant cells that have not been genetically modified;

b) a plant is regenerated from plant cells from Step a); and

c) if necessary, further plants are produced with the help of the plants according to Step b).

[00115] The genetic modification introduced into the plant cell according to Step a) can basically be any type of modification, which leads to the reduction [sic?] of the activity of a Class 3 branching enzyme. The regeneration of the plants according to Step (b) can be carried out using methods known to the person skilled in the art (e.g. described in "Plant Cell Culture Protocols", 1999, edt. by R.D. Hall, Humana Press, ISBN 0-89603-549-2).

[00116] The production of further plants according to Step (c) of the method according to the invention can be carried out, for example, by vegetative propagation (for example using cuttings, tubers or by means of callus culture and regeneration of whole plants) or by sexual propagation. Here, sexual propagation preferably takes place under controlled conditions, i.e. selected plants with particular characteristics are crossed and propagated with one another.

[00117] In a preferred embodiment of the method according to the invention, the genetic modification consists in the introduction of a foreign nucleic acid molecule into the genome of the plant cell, wherein the presence or the expression of said foreign nucleic acid molecule leads to an increased activity of a Class 3 branching enzyme in the cell.

[00118] In a further preferred embodiment, the method according to the invention is used for producing potato plants according to the invention.

[00119] In a further preferred embodiment of the method according to the invention, the foreign nucleic acid molecule is chosen from the group consisting of

a) Nucleic acid molecules, which code a protein with the amino acid sequence given under Seq ID NO 4;

b) Nucleic acid molecules, which code a protein, the amino acid sequence of which has an identity of at least 50% with the amino acid sequence given under SEQ ID NO: 4;

c) Nucleic acid molecules, which include the nucleotide sequence shown under Seq ID

NO 3 or a complimentary sequence;

d) Nucleic acid molecules, the nucleic acid sequence of which has an identity of at least 50% with the nucleic acid sequences described under a) or c);

e) Nucleic acid molecules, which hybridise with at least one strand of the nucleic acid molecules described under a) or c) under stringent conditions;

f) Nucleic acid molecules, the nucleotide sequence of which deviates from the sequence of the nucleic acid molecules identified under a), b), c), d), e) or f) due to the degeneration of the genetic code; and

g) Nucleic acid molecules, which represent fragments, allelic variants and/or derivatives of the nucleic acid molecules identified under a), b), c), d), e) or f).

[00120]   In a further preferred embodiment of the method according to the invention, the foreign nucleic acid molecule is chosen from the group consisting of

a) T-DNA molecules, which lead to an increase in the expression of a Class 3 branching enzyme gene due to integration in the vegetable genome (T-DNA activation tagging);

b) DNA molecules, which contain transposons, which lead to an increase in the expression of a Class 3 branching enzyme gene due to integration in the vegetable genome (transposon activation tagging);

c) DNA molecules, which code a Class 3 branching enzyme and which are linked with regulatory sequences, which guarantee transcription in vegetable cells and lead to an increase in Class 3 branching enzyme activity in the cell;

d) Nucleic acid molecules introduced by means of in vivo mutagenesis, which lead to a mutation or an insertion of a heterologous sequence in at least one endogenous gene coding a Class 3 branching enzyme, wherein the mutation or insertion effects an increase in the expression of a gene coding a Class 3 branching enzyme.

[00121]   The present invention also relates to the plants obtained by the method according to the invention.

[00122]   In a further embodiment of the method according to the invention, the plants according to the invention synthesise a modified starch in comparison with corresponding wild

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type plants that have not been genetically modified.

[00123]   Surprisingly, it has been found that plant cells and plants, which have an increased activity of a Class 3 branching enzyme, synthesise a modified starch.

[00124]   The present invention also relates to the plants obtained by the method according to the invention.

[00125]   The present invention also relates to modified starches obtainable from plant cells according to the invention or plants according to the invention, from propagation material according to the invention or from harvestable plant parts according to the invention.

[00126]   In a particularly preferred embodiment, the present invention relates to modified potato starch.

[00127]   Furthermore the present invention relates to a method for the manufacture of a modified starch including the step of extracting the starch from a plant cell according to the invention or from a plant according to the invention, from propagation material according to the invention of such a plant and/or from harvestable plant parts according to the invention of such a plant, preferably from starch-storing parts according to the invention of a plant. Preferably, such a method also includes the step of harvesting the cultivated plants or plant parts and/or the propagation material of these plants before the extraction of the starch and, further, particularly preferably the step of cultivating plants according to the invention before harvesting.

[00128]   Methods for extracting starches from plants or from starch-storing parts of plants are known to the person skilled in the art. Furthermore, methods for extracting starch from different starch-storing plants are described, e.g. in Starch: Chemistry and Technology (Publisher: Whistler, BeMiller and Paschall (1994), 2nd Edition, Academic Press Inc. London Ltd; ISBN 0-12-746270-8; see e.g. Chapter XII, Page 412-468: Maize and Sorghum Starches: Manufacture; by Watson; Chapter XIII, Page 469-479: Tapioca, Arrowroot and Sago Starches: Manufacture; by Corbishley and Miller; Chapter XIV, Page 479-490: Potato starch: Manufacture and Uses; by Mitch; Chapter XV, Page 491 to 506: Wheat starch: Manufacture, Modification and Uses; by

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Knight and Oson; and Chapter XVI, Page 507 to 528: Rice starch: Manufacture and Uses; by Rohmer and Klem; Maize starch: Eckhoff et al., Cereal Chem. 73 (1996), 54-57, the extraction of maize starch on an industrial scale is generally achieved by so-called "wet milling".). Devices, which are in common use in methods for extracting starch from plant material are separators, decanters, hydrocyclones, spray dryers and fluid bed dryers.

[00129]   In conjunction with the present invention, the term "starch-storing parts" is to be understood to mean such parts of a plant in which, in contrast to transitory leaf starch, starch is stored as a deposit for surviving for longer periods. Preferred starch-storing parts are tubers, storage roots, seeds or endosperm; particularly preferred are potato tubers or the endospermo of maize, wheat or rice plants.

[00130]   Modified starch obtainable by a method according to the invention for manufacturing modified starch is also the subject matter of the present invention.

[00131]   Furthermore, the use of plant cells according to the invention or plants according to the invention for manufacturing a modified starch are the subject matter of the present invention.

[00132]   The person skilled in the art knows that the characteristics of starch can be changed by thermal, chemical, enzymatic or mechanical derivation, for example. Derived starches are particularly suitable for different applications in the foodstuffs and/or non-foodstuffs sector. The starches according to the invention are better suited as a starting substance for the manufacture of derived starches than conventional starches.

[00133]   The present invention therefore also relates to the manufacture of a derived starch, wherein modified starch according to the invention is derived retrospectively.

[00134]   In conjunction with the present invention, the term "derived starch" is to be understood to mean a modified starch according to the invention, the characteristics of which have been changed after isolation from vegetable cells with the help of chemical, enzymatic, thermal or mechanical methods. In a preferred embodiment of the present invention, the derived

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starch according to the invention is starch that has been heat-treated and/or acid-treated. In a further preferred embodiment, the derived starches are starch ethers, in particular starch alkyl ethers, O-allyl ethers, hydroxylalkyl ethers, O-carboxylmethyl ethers, nitrogen-containing starch ethers, phosphate-containing starch ethers or sulphur-containing starch ethers. In a further preferred embodiment, the derived starches are cross-linked starches. In a further preferred embodiment, the derived starches are starch graft polymers. In a further preferred embodiment, the derived starches are oxidised starches. In a further preferred embodiment, the derived starches are starch esters, in particular starch esters, which have been introduced into the starch using organic acids. Particularly preferably these are phosphate, nitrate, sulphate, xanthate, acetate or citrate starches.

[00135] The derived starches according to the invention are suitable for different applications in the foodstuffs and/or non-foodstuffs sector. Methods for manufacturing derived starches according to the invention are known to the person skilled in the art and are adequately described in the general literature. An overview on the manufacture of derived starches can be found, for example, in Orthoefer (in Corn, Chemistry and Technology, 1987, eds. Watson und Ramstad, Chapter 16, 479-499).

[00136] Derived starch obtainable by the method according to the invention for manufacturing a derived starch is also the subject matter of the present invention.

[00137] Furthermore, the use of modified starches according to the invention for manufacturing derived starch is the subject matter of the present invention.

Description of sequences

[00138] SEQ ID NO 1: Nucleic acid sequence containing the coding region of the 3´-area of a Class 3 branching enzyme from *Solanum tuberosum* (cv Désirée). This sequence is inserted in plasmid AN 46-196.

[00139] SEQ ID NO 2: Nucleic acid sequence containing the coding region of the 5´-area of a

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Class 3 branching enzyme from *Solanum tuberosum* (cv Désirée). This sequence is inserted in plasmid AN 47-196.

[00140] SEQ ID NO 3: Nucleic acid sequence containing the full coding region of a Class 3 branching enzyme from *Solanum tuberosum* (cv Désirée). This sequence is inserted in plasmid AN 49 and was deposited with the Deutsche Sammlung von Mikroorganismen und Zellkulturen GmbH, Mascheroder Weg 1b, 38124 Braunschweig, Germany, in accordance with the Budapest Treaty on 15th September 2003 under the number DSM 15926.

[00141] SEQ ID NO 4: Amino acid sequence coding a Class 3 branching enzyme from *Solanum tuberosum* (cv Désirée). This sequence can be derived from the nucleic acid sequence inserted in plasmid AN 49 or from the nucleic acid sequence described under SEQ ID NO 3.

[00142] SEQ ID NO 5: Nucleic acid sequence containing the full coding region of a Class 3 branching enzyme from *Solanum tuberosum* (cv Désirée). This sequence has been obtained by combining the nucleic acid sequences described under SEQ ID NO 1 and SEQ ID NO 2. This nucleic acid sequence constitutes an allelic variant of the nucleic acid sequence described under SEQ ID NO 3 coding a Class 3 branching enzyme.

[00143] SEQ ID NO 6: Amino acid sequence coding a Class 3 branching enzyme from *Solanum tuberosum* (cv Désirée). This sequence can be derived from the nucleic acid sequence described under SEQ ID NO 5 and constitutes an allelic variant of the amino acid sequence described under SEQ ID NO 4 coding a Class 3 branching enzyme.

Description of the figures

[00144] Fig. 1 shows the relative amount of mRNA in seeds of genetically modified rice plants (GOAS0453), expressing a potato branching enzyme Class 3. Also shoen is the example of a genetically non modified wild type plant (wt).

General methods

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[00145] The following methods were used in the examples:

1. Demonstration of the activity of a Class 3 branching enzyme

[00146] The activity of a Class 3 branching enzyme was demonstrated with the help of non-denaturing gel electrophoresis as follows:

[00147] To isolate proteins from plants, the test material was ground with a pestle in liquid nitrogen, absorbed into an extraction buffer (50 mM Na citrate, pH 6.5; 1 mM EDTA, 4 mM DTT) and, after centrifugation (10 min, 14.000 g, 4 °C), was used directly for measurement of the protein content according to Bradford. Subsequently, 5μg to 20 μg total protein extract was mixed with 4X loading buffer (20% glycerol, 125 mM Tris HCl, pH 6.8) and loaded onto a BE activity gel. The BE activity gel was made up as follows: 2.5 ml 30% acrylamide:0.8% bisacrylamide, 0.1 ml running buffer, 7.4 ml H_2O, 10% ammonium persulphate solution and 5 μl N,N,N',N'- tetramethylethylenediamine (TEMED). The running buffer (RB) was made up as follows: RB = 30.2 g Tris base, pH 8.0, 144 g glycine on 1 L H_2O. On completion of the gel run, each of the gels was incubated overnight at 37 °C in 25 ml "phosphorylase buffer" (25 ml 1M Na citrate pH 7.0, 0.47 g glucose-1-phosphate, 12.5 mg AMP, 2.5 mg phosphorylase a/b from "rabbit"). The gels were coloured with Lugol's solution.

2. Transformation of *Oryza sativa* (cv. M202)

[00148] Rice plants were transformed in accordance with the methods described by Hiei et al. (1994, Plant Journal 6(2), 271-282).

3. Starch analysis

a) Determination of the amylose content and of the amylose/amylopectin ratio

[00149] Rice flour was obtained from polished rice by milling the grains in a Cyclotec labmill to particle size smaller than 0,5 mm.

[00150] Amylose content was determined by the method of Juliano.(1971)(Cereal Science Today, 16, p334-340) with slight modifications. 50mg of rice flour are weighed in a 100ml

Erlenmeyer flask and wetted with 1 ml of 95% ethanol to avoid lumping. After addition of 9 ml of 1 M NaOH the sample is heated to 100°C for 20 min, cooled to room temperature and filled up to 100 ml with destilled water.

[00151]   An aliquot of 100 µl is mixed with 10µl 1M acetic acid, 20µl Lugol solution (0,2% I_2 and 2% KI) and 970 µl water. After 10 minutes the OD at 620 nm is determined. The amylose content is calculated from a standard curve generated from samples with defined amount of potato amylose.

b)   Determination of the phosphate content

[00152]   In starch, the positions C2, C3 and C6 of the glucose units can be phosphorylated. Determination of C6-P content of rice starch is performed either on single mature grains hydrolysed in 200 µl of 0,7 M HCl or on 50 mg rice flour hydroylsed in 500 µl 0,7 M HCl.
After 4 h hydrolysis at 95°C under continuous shaking, samples are centrifuged for 10 minutes at 15500xg and the supernatants are applied to a spin module containing 0,2 µm PTFE-filter membran for complete clarification of the hydrolyzate (5 min 1000xg). 20 µl of the supernatants are mixed with 180 µl of imidazole buffer (300 mM imidazole, pH 7.2; 7,5 mM $MgCl_2$, 1 mM EDTA and 0.4 mM NADP). The measurement was carried out in a photometer at 340 nm. After the base absorption had been established, the enzyme reaction was started by addition of 0,4 units glucose-6-phosphate dehydrogenase (from Leuconostoc mesenteroides, Boehringer Mannheim). The change in absorption is directly proportional to the concentration of the G-6-P content of the starch.

[00153]   The total phosphate content was determined by the method of Ames (Methods in Enzymology VIII, (1966), 115-118).

[00154]   Approximately 50 mg of starch are treated with 30 µl of ethanolic magnesium nitrate solution and ashed for 3 hours at 500°C in a muffle oven. The residue is treated with 300 µl of 0.5 M hydrochloric acid and incubated for 30 minutes at 60°C. One aliquot is subsequently made up to 300 µl 0.5 M hydrochloric acid and this is added to a mixture of 100 µl of 10% ascorbic acid and 600 µl of 0.42% ammonium molybdate in 2 M sulphuric acid and incubated for 20 minutes at

45°C.

[00155] This is followed by a photometric determination at 820 nm with a phosphate calibration series as standard.

c) Determination of the viscosity characteristics by means of a Rapid Visco Analyser (RVA)

[00156] 3 g of rice flour (DM) are taken up in 25 ml of H_2O (VE-type water, conductivity of at least 15 mega ohm) and used for the analysis in a Rapid Visco Analyser Super3 (Newport Scientific Pty Ltd., Investmet Support Group, Warriewod NSW 2102, Australia). The apparatus is operated following the manufacturer's instructions. The viscosity values are indicated in Centipoise (cP) in accordance with the manufacturer's operating manual, which is incorporated into the description herewith by reference. To determine the viscosity of the aqueous starch solution, the starch suspension is first stirred for 10 seconds at 960 rpm and subsequently heated at 50°C at a stirring speed of 160 rpm, initially for a minute (step 1). The temperature was then raised from 50°C to 95°C at a heating rate of 12°C per minute (step 2). The temperature is held for 2.5 minutes at 95°C (step 3) and then cooled from 95°C to 50°C at 12°C per minute (step 4). In the last step (step 5), the temperature of 50°C is held for 2 minutes. The viscosity is determined during the entire duration.

[00157] After the program has ended, the stirrer is removed and the beaker covered. The gelatinized starch is now available for the texture analysis after 24 hours incubation at room temperature.

[00158] The profile of the RVA analysis contains parameters which are shown for the comparison of different measurements and substances. In the context of the present invention, the following terms are to be understood as follows:

1. Maximum viscosity (RVA Max)

[00159] The maximum viscosity is understood as meaning the highest viscosity value, measured in cP, obtained in step 2 or 3 of the temperature profile.

2. Minimum viscosity (RVA Min)

[00160] The minimum viscosity is understood as meaning the lowest viscosity value, measured in cP, observed in the temperature profile after the maximum viscosity. Normally, this takes place in step 3 of the temperature profile.

3. Final viscosity (RVA Fin)

[00161] The final viscosity is understood as meaning the viscosity value, measured in cP, observed at the end of the measurement.

4. Setback (RVA Set)

[00162] What is known as the "setback" is calculated by subtracting the value of the final viscosity from that of the minimum occurring after the maximum viscosity in the curve.

5. Gelatinization temperature (RVA PT)

[00163] The gelatinization temperature is understood as meaning the point in time of the temperature profile where, for the first time, the viscosity increases drastically for a brief period.

d) Determination of the gel strength (Texture Analyser)

[00164] 3 g of rice flour (DM) are gelatinized in the RVA apparatus in 25 ml of an aqueous suspension (temperature program: see item c) "Determination of the viscosity characteristics by means of a Rapid Visco Analyser (RVA)") and subsequently stored for 24 hours at room temperature in a sealed container. The samples are fixed under the probe (round piston with planar surface) of a Texture Analyser TA-XT2 from Stable Micro Systems (Surrey, UK) and the gel strength was determined using the following parameters:

- Test speed   0.5 mm/s
- Depth of penetration   7 mm
- Contact surface   113 mm^2
- Pressure   2 g

e) Analysis of the side-chain distribution of the amylopectin by means of ion-exchange chromatography

[00165] To separate amylose and amylopectin, 200 mg of starch are dissolved in 50 ml reaction vessels, using 12 ml of 90% (v/v) DMSO in H_2O. After addition of 3 volumes of ethanol, the precipitate is separated by centrifugation for 10 minutes at about 1800xg at room temperature (RT). The pellet is then washed with 30 ml of ethanol, dried and dissolved in 40 ml of 1% (w/v) NaCl solution at 75°C. After the solution has cooled to 30°C, approximately 90 mg of thymol are added slowly, and this solution is incubated for at least 60 h at 30°C. The solution is then centrifuged for 30 minutes at 2000xg (RT). The supernatant is then treated with 3 volumes of ethanol, and the amylopectin which settles out is separated by centrifugation for 5 minutes at 2000xg (RT). The pellet (amylopectin) is then washed with ethanol and dried using acetone. By addition of DMSO to the pellet, one obtains a 1% solution, of which 200 μl are treated with 345 μl of water, 10 μl of 0.5 M sodium acetate (pH 3.5) and 5 μl of isoamylase (dilution 1:10; Megazyme) and incubated for about 16 hours at 37°C. A 1:5 aqueous dilution of this digest is subsequently filtered through a 0.2 μm filter, and 100 μl of the filtrate are analysed by ion exchange chromatography (HPAEC-PAD, Dionex). Separation was performed using a PA-100 column (with suitable precolumn), while detection was performed amperometrically. The elution conditions were as follows:

[00166]   Solution A - 0.15M NaOH

[00167]   Solution B – 1 M sodium acetate in 0.15M NaOH

t (min)	Solution A (%)	Solution B (%)
5	0	100
35	30	70
45	32	68
60	100	0
70	100	0
72	0	100
80	0	100
Stop		

Table 1: Composition of the elution buffer for the side chain analysis of the amylopectin at different times during the HPEAC-PAD Dionex analysis. Between the times stated, the

composition of the elution buffer changes in each case linearly.

[00168]   The determination of the relative amount of short side chains in the total of all side chains is carried out via the determination of the percentage of a particular side chain in the total of all side chains. The total of all side chains is determined via the determination of the total area under the peaks which represent the polymerization degrees of DP 6 to 34 in the HPCL chromatogram.

[00169]   The percentage of a particular side chain in the total of all side chains is determined via the determination of the ratio of the area under the peak which represents this side chain in the HPLC chromatogram to the total area. The programme Chromelion 6.20 Version 6.20 from Dionex, USA, was used for determining the peak areas.

f)   Determination of the activity of the BEIII protein

[00170]   This was carried out as specified in the example.

g)   DSC-analysis („Differential Scanning Calorimetry")

[00171]   Investigations with the aid of DSC-analysis have been done by the method described by WO 01/19975. 10 mg starch treated with 30 µl H_2O (VE-type water, conductivity of at least 15 mega ohm) were sealed in stainless steal pans (volume 50 µl). The pan is heated from 20°C to 150°C at a rate of 10°C per minute in a Diamond DSC-instrument (Perkin Elmer). The programme Pyres from Perkin Elmer was used for determining the data.

Examples

Example 1

Cloning of a full-length sequence coding a Class 3 branching enzyme from Solanum tuberosum

[00172]   The gene sequence coding for this Class 3 branching enzyme in *Solanum tuberosum* has not previously been described .

[00173]   By sequence comparisons with different branching enzymes, a domain was identified, with the help of which EST databases were examined. In doing so, the EST TC73137 (TIGR

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database; http://www.tigr.org/tigr-scripts/tgi/tc_report.pl?tc=TC73137&species=potato) from potato was identified.

[00174] With the help of the primers B1_Asp (GAT GGG TAC CAG CAC TTC TAC TTG GCA GAG G) and B2_Sal (TCA AGT CGA CCA CAA CCA GTC CAT TTC TGG), a sequence from a tuber-specific cDNA bank from *Solanum tuberosum* (cv. Désirée) corresponding to this EST sequence was amplified. Attempts to use leaf-specific, "sink"-tissue-specific or "source"-tissue-specific cDNA banks as a template for the PCR reaction led to no amplification.

[00175] In order to amplify the whole coding sequence of the branching enzyme concerned, which up to now had also included unknown sequences, primers were manufactured, which were complimentary to the ends of the previously known sequence and vector sequences of the cDNA banks concerned. With all the primer combinations for the amplification of a full-length sequence of a Class 3 branching enzyme used in this approach, it was not possible to amplify any further area. Hereupon, EST databases of tomato were examined again.

[00176] In this case, two ESTs from tomato were identified (TIGR database; BG127920 and TC130382), which either had a high homology to the amplification of the Class 3 branching enzyme from potato described above (TC130382) and (BG127920) respectively, or to the putative branching enzyme gene from arabidopsis (GenBank: GP|9294564|dbj|BAB02827.1).

[00177] Primers were now manufactured again in order to also amplify previously unknown sequences of the Class 3 branching enzyme. By means of PCR, the 3'-area of the Class 3 branching enzyme was amplified from a cDNA bank, made from tubers of *Solanum tuberosum* (cv. Désirée), with the primers KM2_Spe (5'-TCAAACTAGTCACAACCAGTCCATTTCTGG-3') and So_putE (5'-CACTTTAGAAGGTATCAGAGC-3'). The fragment with a size of ca. 1 kb that was obtained was cloned undirectedly in the pCR4-TOPO vector from Invitrogen (product number: 45-0030). The plasmid produced was designated as AN 46-196. The sequence of the inserted fragments in the plasmid AN 46-196 is shown under SEQ ID NO 1.

[00178] The 5'-area was likewise amplified by means of PCR technology and using the

primers So_put5' (5'-GTATTTCTGCGAAGGAACGACC-3') and So_putA (5'-AACAATGCTCTCTCTGTCGG-3') from the same cDNA bank. The fragment with a size of ca. 2 kb that was obtained was cloned undirectedly in the pCR4-TOPO vector from Invitrogen (product number: 45-0030). The plasmid produced was designated as AN 47-196. The sequence of the inserted fragments in the plasmid AN 47-196 is shown under SEQ ID NO 2.

[00179] Primers were now manufactured again in order to amplify a full-length sequence.

[00180] The following primers were used: SO_putA (AACAATGCTCTCTCTGTCGG) and SO_putE (CACTTTAGAAGGTATCAGAGC). A PCR product with an approximate size of 3.2 kb was obtained and was cloned in the pCR2.1 vector from Invitrogen (product number: 45-0030). The plasmid obtained (filed under DSM 15926) was designated as AN 49. The sequence of the inserted fragments in the plasmid AN 49 is shown under SEQ ID NO 3.

Example 2

Information on vectors and plasmids

Manufacture of the expression vector ME5/6

[00181] pGSV71 is a derivative of the plasmid pGSV7, which derives from the intermediate vector pGSV1. pGSV1 constitutes a derivative of pGSC1700, the construction of which has been described by Cornelissen and Vanderwiele (Nucleic Acid Research 17, (1989), 19-25). pGSV1 was obtained from pGSC1700 by deletion of the carbenicillin resistance gene and deletion of the T-DNA sequences of the TL-DNA region of the plasmid pTiB6S3.

[00182] pGSV7 contains the replication origin of the plasmid pBR322 (Bolivar et al., Gene 2, (1977), 95-113) as well as the replication origin of the *Pseudomonas* plasmid pVS1 (Itoh et al., Plasmid 11, (1984), 206). pGSV7 also contains the selectable marker gene *aadA*, from the transposon Tn1331 from *Klebsiella pneumoniae*, which gives resistance against the antibiotics spectinomycin and streptomycin (Tolmasky, Plasmid 24 (3), (1990), 218-226; Tolmasky and Crosa, Plasmid 29(1), (1993), 31-40).

[00183] The plasmid pGSV71 was obtained by cloning a chimeric *bar* gene between the

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border regions of pGSV7. The chimeric *bar* gene contains the promoter sequence of the cauliflower mosaic virus for initiating the transcription (Odell et al., Nature 313, (1985), 180), the *bar* gene from *Streptomyces hygroscopicus* (Thompson et al., Embo J. 6, (1987), 2519-2523) and the 3'-untranslated area of the nopaline synthase gene of the T-DNA of pTiT37 for terminating the transcription and polyadenylation. The *bar* gene provides tolerance against the herbicide glufosinate ammonium.

[00184]   At position 198-222, the T-DNA is given the right edge sequence of the TL-DNA from the plasmid pTiB6S3 (Gielen et al., EMBO J. 3, (1984), 835-846). A polylinker sequence is located between nucleotide 223-249. The nucleotides 250-1634 contain the P35S3 promoter region of the cauliflower mosaic virus (Odell et al., see above). The coding sequence of the phosphinothricin resistance gene (*bar*) from *Streptomyces hygroscopicus* (Thompson et al. 1987, see above) is contained between the nucleotides 1635-2186. At the same time, the two end codons at the 5'-end of the *bar* wild type gene were replaced by the codons ATG and GAC. A polylinker sequence is located between the nucleotides 2187-2205. The 260-bp-long *Taq*I fragment of the untranslated 3'-end of the nopaline synthase gene (3'nos) from the T-DNA of the plasmid pTiT37 (Depicker et al., J. Mol. Appl. Genet. 1, (1982), 561-573) is located between the nucleotides 2206 and 2465. The nucleotides 2466-2519 contain a polylinker sequence. The left edge sequence of the TL-DNA from pTiB6S3 (Gielen et al., EMBO J. 3, (1984), 835-846) is located between the nucleotides 2520-2544.

[00185]   The sector pGSV71 was then cut and smoothed with the enzyme *Pst*I. The B33 promoter and the *ocs* cassette were cut from the vector pB33-Kan as an *Eco*RI-*Hind*III fragment and smoothed and inserted in the vector pGSV71, which had been cut and smoothed with *Pst*I. The vector obtained was used as the starting vector for the construction of ME5/6. An oligonucleotide containing the sites *Eco*RI, *Pac*I, *Spe*I, *Srf*I, *Spe*I, *Not*I, *Pac*I and *Eco*RI was introduced into the *Pst*I site situated between the B33 promoter and *ocs* element while doubling the *Pst*I site. The expression vector obtained was designated as ME5/6.

Manufacture of the expression vector IL103-123

[00186]   In the further course of events, a *Bam*HI fragment of ME5-6 was replaced by a PCR

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product that had been extended by a few sites but was otherwise identical, resulting in the plasmid UL1-17. The B33 promoter contained in UL1-17 was cut out with the restriction enzymes *Hind*III and *Pst*I and the vector relegated after smoothing the ends, producing the vector ML18-56. This vector was opened with *Mun*I and *Pst*I and an MCS synthesised by means of two oligonuclotides with appropriately sticky ends was added. The resulting plasmid ML72-123 was opened with the restriction enzymes *Hpa*I and *Mun*I and oligonucleotides for detection sequences of further restriction enzymes introduced (IR96-123). Subsequently, an *Ecl136II/EcoRV* PCR product for the globulin promoter for rice was spliced into the *EcoRV* site of IR96-123, as a result of which the base vector for an endosperm-specific expression of genes of different origin was produced. The vector is designated in the following as IR103-123.

Manufacture of the plasmid AH33-191

[00187]   The manufacture of the plasmid AH33-191 for an endosperm-specific expression of a potential Class 3 branching enzyme from potato in rice was carried out by splicing an *EcoRV/SacI* fragment of the appropriate cDNA from the plasmid AN49 into the appropriate sites of IR103-123.

Example 3

Genetically modified plants with increased Class 3 branching enzyme activity

[00188]   In order to produce transgenic rice plants, which have an increased expression of a Class 3 branching enzyme gene, the T-DNA of the plasmid AH33-191 was transferred into rice plants (M202) with the help of agrobacteria, as described above under General Methods. Plants obtained by the transformation with the plasmid AH33-191 were designated GAOS0453.

[00189]   Analysis of the transgenic rice plants obtained, with the help of non-denaturising gel electrophoresis of protein extracts from grains of wild type plant cells and/or protein extracts from genetically modified plants, showed that the grains of genetically modified plant cells have an increased activity of a Class 3 branching enzyme in comparison with protein extracts from grains of wild type plant cells.

[00190]   In addition the expression level of potato branching enzyme Class 3 in transgenic rice

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plants was also evaluated by analysis of the amount of mRNA by means of quantitative PCR (Q-PCR).

[00191]   RNA was extracted from single immature seeds (10 to 12 days after pollination). Immature seeds were frozen in liquid nitrogen and homogenized in a ball mill (MM200, Retsch, Germany, at 30Hz, 45 seconds, 4 mm ball). Afterwards RNA was isolated by use of the SV 96 total RNA Isolation System (Promega, Prd. No. Z3500 according to manufacturers specifications (protocol No. 294) before it was treated with 10 µl each of RQ1 RNase-Free-DNase (Promega, Prd. No. M6101) according to manufacturers specifications. Equal amounts of RNA isolated from four single seeds harvested from one single plant was pooled before analysis by quantitative PCR.

[00192]   Quantitative PCR analysis was carried out by use of the Access RT-PCR System (Promega, Prd. No. A1260) according to the manufacturers specifications. Under the used conditions the following amplification primers were hybridizing specifically to RNA of potato starch branching enzyme Class 3: St_BE-f2 (TCA GGT CTA CAA GTT GAC CCG A) and _BE-r2 (GTA GAA CCT TCC CTT TTG TGT GA). For monitoring expression levels the primer St_BE-Fam(2) labelled with two fluorescent dyes (FAM-CAT GAT CAC TCT AGC AAT CAA AGT GCC-TAMRA) was used.

[00193]   For calculation of relative expression levels an endogenous mRNA present in all plants, coding S-adenosylmethionindecarboxylase was amplified in parallel by using the following amplification primers: S-AMD-F1 (GGC TTC GAC GCC TCT ACT CT) AND S-AMD-R2 (AAG GGC CAA AGC ACC TGA G). The primer FAM-S-AMD labelled with two fluorescent dyes (FAM-ACC CTC TTC ACC AGG TCG CCA-TAMRA) was included into each of the reactions.

[00194]   The Q-PCR reaction was carried out each in a total volume of 30 µl comprising 350 ng RNA extracted from plants, AMV/Tfl reaction buffer (provided with Promega Prd. No. A1260), 3 mM MgSO$_4$, 500 nM of the respective primers, 0,2 mM of each desoxyribonucleotide, 0,6 µl reverse transcriptase, 0,6 µl Tfl Polymerase (according to Promega's protocol 294) and in addition 150 nM fluorescent primer ST_BE-Fam(2) or 100 nM of fluorescent primer FAM-

S_AMD, respectively. Control reactions performed in parallel did not contain reverse transcriptase.

[00195]   Reaction conditions for Q-RT-PCR:

  Step 1: 55°C   30 minutes
  Step 2: 94°C   2 minutes
  Step 3: 94°C   15 seconds
  Step 4: 60°C   1 minute
  40 repeats were performed between step 3 and step 4.

[00196]   The fluorescent signal was detected during step 4 with ABI Prism 7700 (Applied Biosystems) equipment.

[00197]   Relative expression levels of the respective transcripts were calculated as described in M. W. Pfaffl (2001,"A new mathematical model for relative quantification in real-time RT-PCR", Nucleic Acids Res. 29(9):e45) Therefore the expression levels of transcripts coding potato branching enzyme Class 3 were calculated as relative amounts compared to the expression levels of transcripts coding S-adenosylmethionindecarboxylase, which is highly and consistently expressed during seed development in rice. The relative expression levels calculated as just described, are shown in Fig 1.

Patent claims

1. Genetically modified plant cell, characterised in that it has an increased activity of at least one Class 3 branching enzyme in comparison with corresponding wild type plant cells that have not been genetically modified.

2. Genetically modified plant cell according to Claim 1, wherein the genetic modification consists in the introduction of at least one foreign nucleic acid molecule into the genome of the plant.

3. Genetically modified plant cell according to Claim 2, wherein the foreign nucleic acid molecule codes a Class 3 branching enzyme.

4. Genetically modified plant cell according to Claim 3, wherein the said foreign nucleic acid molecule is chosen from the group consisting of

   a) Nucleic acid molecules, which code a protein with the amino acid sequence given under Seq ID NO 4;

   b) Nucleic acid molecules, which code a protein, the amino acid sequence of which has an identity of at least 50% with the amino acid sequence given under SEQ ID NO: 4;

   c) Nucleic acid molecules, which include the nucleotide sequence shown under Seq ID NO 3 or a complimentary sequence;

   d) Nucleic acid molecules, the nucleic acid sequence of which has an identity of at least 50% with the nucleic acid sequences described under a) or c);

   e) Nucleic acid molecules, which hybridise with at least one strand of the nucleic acid molecules described under a) or c) under stringent conditions;

   f) Nucleic acid molecules, the nucleotide sequence of which deviates from the sequence of the nucleic acid molecules identified under a), b), c), d), e) or f) due to the degeneration of the genetic code; and

   g) Nucleic acid molecules, which represent fragments, allelic variants and/or derivatives of the nucleic acid molecules identified under a), b), c), d), e) or f).

5. Genetically modified plant cell according to one of Claims 2 to 4, wherein the said foreign nucleic acid molecule is chosen from the group consisting of

   a) T-DNA molecules, which lead to an increase in the expression of a Class 3 branching enzyme gene due to integration in the vegetable genome (T-DNA activation tagging);

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b) DNA molecules, which contain transposons, which lead to an increase in the expression of a Class 3 branching enzyme gene due to integration in the vegetable genome (transposon activation tagging);

c) DNA molecules, which code a Class 3 branching enzyme and which are linked with regulatory sequences, which guarantee transcription in vegetable cells and lead to an increase in Class 3 branching enzyme activity in the cell.

d) Nucleic acid molecules introduced by means of in vivo mutagenesis, which lead to a mutation or an insertion of a heterologous sequence in at least one endogenous gene coding a Class 3 branching enzyme, wherein the mutation or insertion effects an increase in the expression of a gene coding a Class 3 branching enzyme.

6. Plant cell according to one of Claims 1 to 5, which synthesises a modified starch in comparison with corresponding wild type plant cells that have not been genetically modified.

7. Plant containing plant cells according to one of Claims 1 to 6.

8. Plant according to Claim 7, which is a starch-storing plant.

9. Plant according to Claim 7, which is a maize, rice, wheat, rye, oat, barley, cassava, potato, sago, mung bean, pea or sorghum plant.

10. Plant according to Claim 9, which is a potato plant.

11. Propagation material of plants according to one of Claims 7 to 10, containing plant cells according to one of Claims 1 to 6.

12. Harvestable plant parts of plants according to one of Claims 7 to 10, containing plant cells according to one of Claims 1 to 6.

13. Method for the manufacture of a genetically modified plant according to one of Claims 7 to 10, wherein

a) a plant cell is genetically modified, whereby the genetic modification leads to an increase in the activity of a Class 3 vegetable branching enzyme in comparison with corresponding wild type plant cells that have not been genetically modified;

b) a plant is regenerated from plant cells from Step a); and

c) if necessary, further plants are produced with the help of the plants according to Step b).

14. Method according to Claim 13, wherein the genetic modification consists in the

introduction of a foreign nucleic acid molecule into the genome of the plant.

15. Method according to Claim 14, wherein the said foreign nucleic acid molecule is chosen from the group consisting of

a) Nucleic acid molecules, which code a protein with the amino acid sequence given under Seq ID NO 4;

b) Nucleic acid molecules, which code a protein, the amino acid sequence of which has an identity of at least 50% with the amino acid sequence given under SEQ ID NO: 4;

c) Nucleic acid molecules, which include the nucleotide sequence shown under Seq ID NO 3 or a complimentary sequence;

d) Nucleic acid molecules, the nucleic acid sequence of which has an identity of at least 50% with the nucleic acid sequences described under a) or c);

e) Nucleic acid molecules, which hybridise with at least one strand of the nucleic acid molecules described under a) or c) under stringent conditions;

f) Nucleic acid molecules, the nucleotide sequence of which deviates from the sequence of the nucleic acid molecules identified under a), b), c), d), e) or f) due to the degeneration of the genetic code; and

g) Nucleic acid molecules, which represent fragments, allelic variants and/or derivatives of the nucleic acid molecules identified under a), b), c), d), e) or f).

16. Method according to Claim 14, wherein the said foreign nucleic acid molecule is chosen from the group consisting of

a) T-DNA molecules, which lead to an increase in the expression of a Class 3 branching enzyme gene due to integration in the vegetable genome (T-DNA activation tagging);

b) DNA molecules, which contain transposons, which lead to an increase in the expression of a Class 3 branching enzyme gene due to integration in the vegetable genome (transposon activation tagging);

c) DNA molecules, which code a Class 3 branching enzyme and which are linked with regulatory sequences, which guarantee transcription in vegetable cells and lead to an increase in Class 3 branching enzyme activity in the cell;

d) Nucleic acid molecules introduced by means of in vivo mutagenesis, which lead to a mutation or an insertion of a heterologous sequence in at least one endogenous gene coding a Class 3 branching enzyme, wherein the mutation or insertion effects an increase

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in the expression of a gene coding a Class 3 branching enzyme.

17. Method according to one of Claims 13 to 16, wherein the genetically modified plant synthesises a modified starch in comparison with corresponding wild type plants that have not been genetically modified.

18. Modified starch obtainable from a genetically modified plant according to one of Claims 7 to 10, from propagation material according to Claim 11, or from harvestable plant parts according to Claim 12.

19. Method for the manufacture of a modified starch including the step of extracting the starch from a plant cell according to one of Claims 1 to 6.

20. Method for the manufacture of a modified starch including the step of extracting the starch from a plant according to one of Claims 7 to 10.

21. Method for the manufacture of a modified starch including the step of extracting the starch from harvestable plant parts according to Claim 12.

22. Method for the manufacture of a derived starch, wherein modified starch according to Claim 18 or obtainable by means of a method according to one of Claims 19, 20 or 21 is derived.

23. Use of genetically modified plants according to one of Claims 7 to 10 for the manufacture of a modified starch.

24. Modified starch obtainable by means of a method according to one of Claims 19, 20 or 21.

25. Derived starch obtainable by means of a method according to Claim 22.

26. Use of modified starch according to one of Claims 18 or 24 for the manufacture of derived starch.

Abstract

The present invention relates to plant cells and plants, which are genetically modified, wherein the genetic modification leads to an increase in the activity of a Class 3 vegetable branching enzyme in comparison with corresponding wild type plant cells or wild type plants that have not been genetically modified. Furthermore, the present invention relates to means and methods for the manufacture of such plant cells and plants. Plant cells and plants of this type synthesise a modified starch. The present invention therefore also relates to the starch synthesised by the plant cells and plants according to the invention as well as to methods for the manufacture of the starch and to the manufacture of starch derivatives of this modified starch.
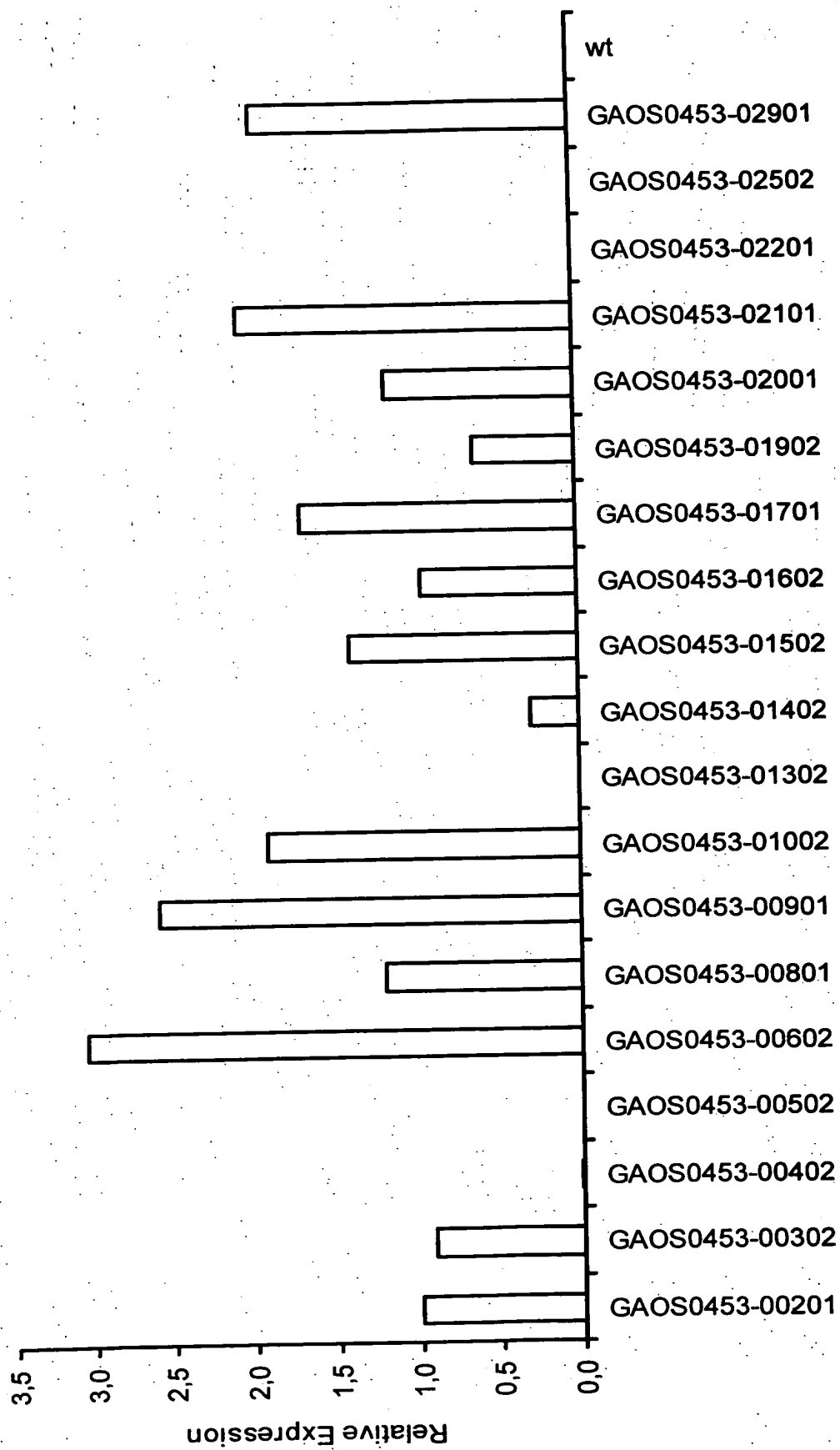
Fig 1

SwissProt Acc No. or Entry Name	Amino acid No.	SwissProt Acc No. or Entry Name	Amino acid No.
APU_THETU	1251-1331	Q9XED2	101-191
GLGB_SYNY3	22-110	Q08131	137-227
P71095	39-130	GLGB_HUMAN	73-168
Q9RXB0	181-274	Q9V6K7	52-144
PULA_KLEPN	301-395	Q22137	53-147
P70983	1143-1238	Q9RM63	25-149
Q41386	205-298	ISOA_FLASP	36-163
O64454	202-295	ISOA_PSEAY	30-155
O69008	105-191	P73608	22-122
O34587	104-189	O04196	74-177
Q9XDB5	231-319	Q9SPT7	8-110
PULA_THEMA	223-311	Q41742	114-218
Q59319	206-300	GLGX_HAEIN	10-101
YIEL_ECOLI	41-123	Q9RNH5	20-117
Q9RX51	22-100	GLGX_ECOLI	9-104
O66936	24-116	Q9RXP5	13-108
Q59832	141-233	GLGX_MYCTU	24-119
GLGB_STRAU	160-252	Q9X947	18-113
GLGB_BUTFI	24-116	P72691	19-120
GLGB_AGRTU	130-223	P95868	17-117
Q9RQI5	134-226	O84046	11-108
GLGB_ECOLI	122-214	Q9Z8F5	11-108
GLGB_HAEIN	122-214	Q9ZVT2	232-335
GLGB_SYNY3	126-217	Q44528	2-83
GLGB_MYCTU	127-223	Q9X2G0	276-357
Q9RTB7	26-115	Q9X2G0	15-98
GLGB_BACSU	23-115	Q45643	46-114
Q59242	23-115	Q9X2G0	126-217
O84874	117-209	TREZ_ARTSQ	5-90
O49185	62-153	TREZ_MYCTU	2-68
GLGB_YEAST	59-153	Q55088	1-79
Q9Y8H3	47-147	Q53641	1-79

Table 1   Amino acid sequences, contained in the "seed alignment", that are used for producing the HMM for the Pfam isoamylase domain (PF 02922). The table gives the "accession" number (Acc No) or the name (Entry Name), under which the corresponding amino acid sequences are entered in the SwissProt database. Those sections of the amino acid sequences of the corresponding SwissProt entry, which are part of the "seed alignment" (amino acid No.), are also given.

SwissProt Acc No. or Entry Name	Amino acid No.	SwissProt Acc No. or Entry Name	Amino acid No.
AMYM_BACLI	137-479	CDG1_PAEMA	46-426
MALZ_ECOLI	128-522	CDGT_BACOH	44-420
APU_THESA	393-821	AMYB_PAEPO	751-1107
APU_THEET	390-820	AMYA_ASPOR	34-390
CDAS_THEET	136-494	AMY1_DEBOC	49-405
NEPU_BACST	139-497	AMY1_SACFI	40-396
AMYM_BACAD	139-497	AMY1_ECOLI	193-611
AMY2_DICTH	138-470	ISOA_PSEAY	209-652
MALT_AEDAE	29-425	AMY_BUTFI	126-520
MAL2_DROME	30-432	AMY_BACSU	41-383
MAL3_DROME	31-428	AMY_THECU	40-392
MAL1_DROME	35-420	AMY_STRHY	37-360
MAXS_YEAST	17-441	AMY_STRGR	35-372
MAYS_YEAST	22-446	AMY_ALTHA	28-373
MA3S_YEAST	21-443	AMYA_AERHY	26-369
TREC_ECOLI	15-414	AMYC_HUMAN	26-413
TREC_BACSU	16-418	AMYA_DROME	29-396
O16G_BACSP	11-420	AMY1_AERHY	22-379
O16G_BACCE	13-419	AMT4_PSESA	38-387
DEXB_STRMU	13-394	AMY2_ECOLI	12-402
AMY_BACME	44-406	AMY_BACLI	34-420
AMY3_DICTH	39-381	AMY_BACAM	34-422
AMY_STRLI	77-520	AMT6_BACS7	40-426
CDGT_KLEPN	47-463	AMY3_WHEAT	26-348
AMYM_BACST	46-430	AM3A_ORYSA	29-367
CDGT_BACST	47-425	AMYA_VIGMU	24-361
AMYR_BACS8	46-425	AM2A_ORYSA	23-366

Table.2   Amino acid sequences, contained in the "seed alignment", that are used for producing the HMM for the Pfam alpha-amylase domain (PF 00128). The table gives the "accession" number (Acc No) or the name (Entry Name), under which the corresponding amino acid sequences are entered in the SwissProt database. Those sections of the amino acid sequences of the corresponding SwissProt entry, which are part of the "seed alignment" (amino acid No.), are also given.

Table 3 Information for producing the HMM for the Pfam isoamylase domain (PF 02922)

```
HMMER2.0 [2.3.1]
NAME  isoamylase_N
ACC   PF02922
DESC  Isoamylase N-term
LENG  121
ALPH  Amino
RF    no
CS    no
MAP   yes
COM   hmmbuild -F HMM_Is.ann SEED.ann
COM   hmmcalibrate --seed 0 HMM_Is.ann
NSEQ  65
DATE
CKSUM 3012
GA    2.3 2.3
TC    2.3 2.3
NC    2.1 2.1
XT    -8455     -4  -1000  -8455     -4  -1000  -8455     -4  -8455     -4
NULT    -4  -8455
NULE   595  -1558     85    338   -294    453  -1158    197    249    902  -1085   -142    -21   -313     45    531    201    384  -1998   -644
EVD  -56.839790 0.222419
HMM        A      C      D      E      F      G      H      I      K      L      M      N      P      Q      R      S      T      V      W      Y
         m->m   m->i   m->d   i->m   i->i   d->m   d->d   b->m   m->e
         -32      *   -5527
     1   433  -2912  -5203  -4583    312  -4575  -3427  -2412  -4218  -2763    739  -4157   2303  -3877  -1058   -777    159  -2330   1852   3373     1
         -149   -500    233     43   -381    399    106   -626    210   -466   -720    275    394     45     96    359    117   -369   -294   -249
           -1 -10660 -11703   -894  -1115   -701  -1378    -32
     2   -503  -4276   -455   1534    635   1339  -2632  -1609    373     78    463  -1115   -680    241  -2737   -924   -593  -1619     43    316     2
         -149   -500    233     43   -381    399    106   -626    210   -466   -720    275    394     45     96    359    117   -369   -294   -249
           -1 -10857 -11899   -894  -1115   -701  -1378      *
     3   -806  -4386  -2899    -88  -1199  -4001   -313  -1878   1255  -1032  -3486  -2653   2668   -172    105    545    387   -400  -4594  -3936     3
         -149   -500    233     43   -381    399    106   -626    210   -466   -720    275    394     45     96    359    117   -369   -294   -249
           -1 -10916 -11958   -894  -1115   -701  -1378      *
     4  -1972  -3101  -5615  -1806   2143  -2106  -3692   -829  -4575   2525   1112  -4465  -4871  -4199  -4376  -1753  -1159  -2514  -3558   1139     4
         -149   -500    233     43   -381    399    106   -626    210   -466   -720    275    394     45     96    359    117   -369   -294   -249
           -1 -10916 -11958   -894  -1115   -701  -1378      *
     5  -1028  -6327  -1172   -753  -6643   3551  -4321   -471  -1174  -6434  -5732  -3689  -5515  -3996  -5049  -4652  -4943  -6008    166  -5877     5
         -149   -500    233     43   -381    399    106   -626    210   -466   -720    275    394     45     96    359    117   -369   -294   -249
           -1 -10941 -11983   -894  -1115   -701  -1378      *
     6   2712    446  -5632  -1558    482  -1817  -3713   -635  -4593    -29  -2327  -4485    109  -4218  -4397   -260  -3237    343  -3582    161     6
         -149   -500    233     43   -381    399    106   -626    210   -466   -720    275    394     45     96    359    117   -369   -294   -249
           -1 -10941 -11983   -894  -1115   -701  -1378
```

Table 3, Sheet 1/9

Table 3, Sheet 2/9

Each group (21–35) is shown as three stacked lines (a = data, b and c = coefficient lines) across 20 columns.

Group	c1	c2	c3	c4	c5	c6	c7	c8	c9	c10	c11	c12	c13	c14	c15	c16	c17	c18	c19	c20
21a	-903	-3200	-5719	-5083	-433	-1893	-3792	860	-4678	-1338	-2403	-4567	-543	-4301	-4478	-4006	2145	2518	1631	512
21b	-149	-500	233	43	-381	399	106	-626	210	-466	-720	275	394	45	96	359	117	-369	-294	-249
21c	-1	-11023	-12065	-894	-1115	-701	-1378													
22a	-1902	-4488	-1380	-132	190	-4097	-526	406	-450	-4488	-3587	1974	-4189	-2312	1656	-1028	1578	714	-4694	444
22b	-149	-500	233	43	-381	399	106	-626	210	-466	-720	275	394	45	96	359	117	-369	-294	-249
22c	-1	-11023	-12065	-894	-1115	-701	-1378													
23a	-1835	-3207	-5724	-5089	3969	-2056	-3796	-432	-4684	-325	-2409	-4572	-4977	-4306	-1411	-1974	-3321	-410	-3659	1564
23b	-149	-500	233	43	-381	399	106	-626	210	-466	-720	275	394	45	96	359	117	-369	-294	-249
23c	-1	-11023	-12065	-894	-1115	-701	-1378													
24a	1377	1196	-1346	-2546	-4550	-4149	-2821	-1804	963	-2327	-3447	-2834	-1077	-2403	2409	501	896	-3897	-4578	531
24b	-149	-500	233	43	-381	399	106	-626	210	-466	-720	275	394	45	96	359	117	-369	-294	-249
24c	-1	-11023	-12065	-894	-1115	-701	-1378													
25a	-1482	-3277	-1253	931	-116	-5013	-3887	-1194	-4761	1669	-2465	-4654	-5058	-4386	-4568	-4099	-3396	2623	-3750	265
25b	-149	-500	233	43	-381	399	106	-626	210	-466	-720	275	394	45	96	359	117	-369	-294	-249
25c	-1	-11023	-12065	-894	-1115	-701	-1378													
26a	-7635	-6573	-7990	-1924	2064	-1893	-4102	-6546	-7815	-5859	-5949	-6513	-7759	-6639	-1618	-7150	-7486	-6697	5535	2570
26b	-149	-500	233	43	-381	399	106	-626	210	-466	-720	275	394	45	96	359	117	-369	-294	-249
26c	-1	-11023	-12065	-894	-1115	-701	-1378													
27a	2849	-4354	-5323	-4910	-5332	-4813	-4712	-4952	-1677	-1991	-4458	-1206	-5320	-4560	-4834	2037	97	-4553	392	-5256
27b	-149	-500	233	43	-381	399	106	-626	210	-466	-720	275	394	45	96	359	117	-369	-294	-249
27c	-1	-11023	-12065	-894	-1115	-701	-1378													
28a	-464	-4943	-3578	156	-5759	-1752	-3603	-5508	-1616	-5465	-4564	-3477	3730	-3175	-1215	697	-1675	-4961	-5617	-4985
28b	-149	-500	233	43	-381	399	106	-626	210	-466	-720	275	394	45	96	359	117	-369	-294	-249
28c	-1	-11023	-12065	-894	-1115	-701	-1378													
29a	-36	-4571	-945	163	-4892	336	2269	-2129	-74	-4587	-3661	2138	-4166	261	-1460	-822	1414	-682	-4755	700
29b	-149	-500	233	43	-381	399	106	-626	210	-466	-720	275	394	45	96	359	117	-369	-294	-249
29c	-1	-11023	-12065	-894	-1115	-701	-1378													
30a	3362	-5060	-3960	-1527	-6477	-2136	-4534	-6257	-4423	-6303	-5432	-1004	-811	-1072	-4921	178	-4321	-1832	-6500	-5893
30b	-149	-500	233	43	-381	399	106	-626	210	-466	-720	275	394	45	96	359	117	-369	-294	-249
30c	-18	-11023	-12065	-894	-1115	-701	-1378													
31a	-1049	-4555	-6420	1463	-4875	-4058	-2716	-993	1147	-2673	-863	-983	-4151	1892	1235	-590	1202	-788	-4739	-834
31b	-149	-500	233	43	-381	399	106	-626	210	-466	-720	275	394	45	96	359	117	-369	-294	-249
31c	-1	-11023	-12065	-894	-1115	-701	-1378													
32a	-331	-4572	491	954	-1179	489	-470	-4643	352	-2337	-3661	1027	-1906	-33	1510	470	-638	-1807	122	-866
32b	-149	-500	233	43	-381	399	106	-626	210	-466	-720	275	394	45	96	359	117	-369	-294	-249
32c	-1	-11006	-12048	-894	-1115	-444	-1916													
33a	922	36	-7042	-6525	-4477	-6466	-5600	-626	-6240	-1110	-433	-6118	-6412	-5948	-2134	-5634	-4511	3460	-5365	-4988
33b	-149	-500	233	43	-381	399	106	-626	210	-466	-720	275	394	45	96	359	117	-369	-294	-249
33c	-1	-11023	-12065	-894	-1115	-701	-1378													
34a	619	-4558	-156	758	-499	-4076	-481	-1791	587	-2183	-3649	-2714	-4169	-413	962	1507	976	-1017	-4745	910
34b	-149	-500	233	43	-381	399	106	-626	210	-466	-720	275	394	45	96	359	117	-369	-294	-249
34c	-1	-11023	-12065	-894	-1115	-701	-1378													
35a	-2161	-4635	-7592	-7120	-1252	-1604	-6387	540	-6901	2467	-3458	-6804	-6949	-6529	-6803	-6367	-5011	2356	-5892	-5607
35b	-149	-500	233	43	-381	399	106	-626	210	-466	-720	275	394	45	96	359	117	-369	-294	-249
35c	-1	-11023	-12065	-894	-1115	-701	-1378													

Table 3, Sheet 4/9

Right block (each cell: value / index)

row	C(-249)	C(-294)	C(-369)	C(117)	C(359)	C(96)	C(45)	C(394)	C(275)	C(-720)	C(-466)	C(210)	C(-626)
36	-218	-3666	1652	194	-1302	-1396	-1129	-4956	-4518	-41	248	140	1189
37	-3925	-4259	945	-1925	-4605	-5089	-4899	-5523	-5161	-2773	1969	-5277	-501
38	2201	-4386	-1060	-667	914	-3095	-1254	-198	-282	-3222	-1377	-2644	-1027
39	-4072	-4755	-1613	-637	55	-1098	-2272	-4166	-715	-3660	-4587	414	-4642
40	-4075	-4758	-4196	-302	-914	-1400	-2273	1201	3036	-3664	-1673	367	-4646
41	96	189	-678	-459	-398	-215	-772	194	2273	-3593	-2300	-2246	-4574
42	-263	-3757	-3195	735	504	-1822	-1275	-267	1007	-2663	-1313	-50	-3645
43	-2869	-3552	-979	-45	-1778	-284	1860	-226	771	-2457	-100	-1111	-3438
44	-2292	-2974	-338	269	644	447	-494	64	897	-1880	-2805	1750	-2859
46	-2736	-3646	-3025	-1715	-1382	-1954	-734	2482	1862	-2733	-3463	-1203	-3545
47	-3708	5255	-1471	-905	-2625	645	-385	-1213	-2355	-3291	-1027	689	-4263
48	361	-4303	495	-2712	-137	-2546	383	960	1492	-3186	-2023	-2051	-615
49	50	1382	-242	819	-1260	-654	159	461	-2734	-3612	-1569	-98	-242
50	-4067	-4748	-488	807	22	1235	1003	-4169	536	1409	-1440	-725	-119

Left block (each cell: value / index1 / index2)

row	L1 (-149/-1)	L2 (-500/-11023)	L3 (233/-12065)	L4 (43/-894)	L5 (-381/-1115)	L6 (106/-1378)	L7 (399/-701)
36	557	2801	-1721	-4985	-388	-248	-4905
37	-924	-3659	-6262	-5655	-56	-4436	2370
38	-3164	-4080	2121	-411	1807	-2937	-919
39	-1317	-4571	1686	-44	3174	570	-452
40	584	-4574	362	369	-4895	-2733	-1946
41	-74 / -1777	-4504	-4329	142	-4824	1065	1166
42	-1080 / 10	-10949 / -3574	-926 / 1431	899	-3894	-1734	1158
43	-258 / -1897	-9872 / -3368	-2622 / 980	558	-3688	1508	-5207
44	-786 / -1320 / -145	-9617 / -2790	-1256 / 642	-620	-3110	845	-5379
45	-4000 / -1645	-1761 / -3285	-638 / 2437	-49 / -36	-4913 / -3659	-5694 / -1761	-407
46	-624 / -2743	-7357 / -4200	-1535 / -915	509	-4517	303	-3717
47	-1155	-10608 / -4079	-11650 / 2253	-120	-880	1342	-3058 / -3775
48	656	-10641 / -4516	-11683 / -1114	731	-1260	465	1230
49	-3100	-11023 / -4560	-12065 / -1116	1388	96	885	-908

	-149	-500	233	43	-381	399	106	-626	210	-466	-720	275	394	45	96	359	117	-369	-294	-249
50	941	-115	-708	1773	-4860	-1149	-2738	-824*	-1301*	-2538	698	-1344	-4171	-814	930	554	1279	-254	-4739	-4062
51	-420	-3382	-1879	-4044	439	-4712	3032	1305*	-703*	332	-2575	364	-4775	-722	-67	-3740	41	1148	-3814	285
52	-1952	-4573	-58	669	-4895	-4073	-2732	-4645*	-493*	-4589	-3663	-338	2995	1442	619	-833	-73	-260	-4757	-4074
53	-1019	-3213	-1623	-1804	-243	-4921	-3789	-2702*	-1610*	1632	4259	-4550	-4971	-4279	-4465	-4004	-3320	-593	-3668	798
54	-1227	-4571	654	1153	-4892	-1716	1453	-1841*	1364*	-4587	-3661	-2708	59	-40	903	-880	1286	260	-4755	34
55	-2745	-4145	-2622	504	-415	-3731	392	-4166*	1748*	-594	-372	-768	1315	-1943	1913	493	-1052	-1625	-4347	183
56	-1634	-2867	129	-1035	-3099	918	-1317	-330*	201*	713	-1982	-1326	-2738	-894	930	1536	714	-2441	-3108	-2486
57	-1723	-9243	-524	1978	-2771	1477	-678	-2535*	1066*	-2508	-1648	-560	-2097	-257	-717	-1002	-1082	-2134	-2876	1915
58	-1253	-7810	-796	-1034	-1461	-2223	-963	-1010*	-885*	-66	1503	-1180	-2299	-782	1512	-1199	1429	886	-1816	-1370
59	-2441	-3911	36	615	-610	-1517	1889	-3980*	1238*	-227	-3000	1723	366	-1615	1057	-1067	-2380	479	-4095	-3413
60	-78	-10278	-4270	-249	-4496	825	-235	-923*	391*	-577	-3265	976	-3770	-602	1682	165	-1303	-978	-4359	-3876
61	-713	-4275	2377	1673	-4595	133	-2427	-1328*	-1103*	-4291	-3366	-246	-1321	-1969	-2526	-881	1896	-3897	-4459	-3773
62	-443	-4504	216	-81	1410	1699	-313	-4575*	-1074*	-4520	-3593	1620	-329	2	-304	636	-837	-4126	-4687	-209
63	-1102	-4838	403	-2956	-707	3185	-502	-4688*	-3155*	-4786	-746	1368	-4754	-1258	-3662	-3660	-3684	-4391	-4953	421

Table 3, Sheet 5/9

Table 3, Sheet 6/9

	65	66	67	68	69	70	71	72	73	75	76	78	79	80	81
	674 / -249	1346 / -249	-4055 / -249	-3338 / -249	1250 / -249	-3395 / -249	-4074 / -249	-3369 / -249	-2272 / -250	-3243 / -249	-5028 / -250	-1309 / -249	-845 / -249	-3384 / -249	-1177 / -249
	1942 / -294	6021 / -294	-4735 / -294	1543 / -294	-4629 / -294	163 / -294	-4757 / -294	-4052 / -294	-2953 / -296	-4061 / -294	-4854 / -296	-1672 / -294	-4495 / -294	2649 / -294	-4755 / -294
	2648 / -369	-6724 / -369	-1784 / -369	1675 / -369	1122 / -369	2065 / -369	-4196 / -369	-1418 / -369	-2385 / -368	-3409 / -369	-4841 / -368	633 / -369	-489 / -369	820 / -369	-4194 / -369
	105 / 117	-7532 / 117	956 / 117	-68 / 117	1595 / 117	-1271 / 117	664 / 117	-203 / 117	-1245 / 116	989 / 117	-3663 / 118	-1206 / 117	284 / 117	-1758 / 117	172 / 117
	-4005 / 359	-7179 / 359	1595 / 359	-4028 / 359	-411 / 359	-4083 / 359	-922 / 359	-774 / 359	1120 / 359	-1905 / 359	-3491 / 363	228 / 359	-213 / 359	-1080 / 359	-661 / 359
	-4477 / 96	-7320 / 96	-312 / 96	-4500 / 96	-22 / 96	-4556 / 96	-1334 / 96	131 / 96	-1030 / 95	-2288 / 96	-3154 / 95	-2112 / 96	-2683 / 96	-945 / 96	-2819 / 96
	-4300 / 45	-6676 / 45	-2262 / 45	-4323 / 45	-707 / 45	-4379 / 45	-2273 / 45	23 / 45	-480 / 47	-1307 / 45	-3494 / 44	-1824 / 45	-2140 / 45	-1436 / 45	-929 / 45
	-4971 / 394	-7780 / 394	-4153 / 394	-4992 / 394	-4215 / 394	-5043 / 394	3130 / 394	531 / 394	-2368 / 395	865 / 394	-4255 / 393	2442 / 394	-482 / 394	-110 / 394	1991 / 394
	-1483 / 275	-6534 / 275	-2697 / 275	-4589 / 275	-1371 / 275	-4642 / 275	-423 / 275	754 / 275	1347 / 277	2772 / 275	-3488 / 276	-2139 / 275	-162 / 275	-1534 / 275	-1041 / 275
	-2403 / -720	-5967 / -720	-3640 / -720	-209 / -720	-3509 / -720	-2463 / -720	-3663 / -720	-2958 / -720	-1858 / -722	-3056 / -720	-4841 / -722	-424 / -720	-3384 / -720	-2502 / -720	-3661 / -720
	-810 / -466	-5868 / -466	-4563 / -466	1112 / -466	-2213 / -466	1905 / -466	-4590 / -466	-1291 / -466	-563 / -467	-3872 / -466	-5453 / -465	267 / -466	-622 / -466	1775 / -466	-2482 / -466
	-422 / 210	-7962 / 210	-2304 / 210	-4700 / 210	-571 / 210	-1620 / 210	-597 / 210	383 / 210	1226 / 211	-1635 / 210	777 / 211	-2084 / 210	-1276 / 210	-963 / 210	1572 / 210
	1807 / -626	-6567 / -626	-4613 / -626	1715 / -626	-4347 / -626	1839 / -626	-4645 / -626	-3940 / -626	-2828 / -627	-3935 / -626	-5604 / -627	-733 / -626	504 / -626	1526 / -626	-1497 / -626
	-3792 / 106	-4105 / 106	3120 / 106	-2088 / 106	-3816 / 106	-415 / 106	-3875 / 106	-2028 / 106	-181 / 104	-1685 / 106	-3660 / 104	-1566 / 106	-2585 / 106	-3621 / 106	1424 / 106
-1378	-7926 / -701	1262 / -701	-2001 / -701	-675 / -701	-4124 / -701	-430 / -701	-3223 / -701	2429 / -701	-2270 / 397	136 / -701	3620 / 397	-2717 / -701	495 / -701	-92 / -701	291 / -701

64: -990 / -149 / -1 / -7684
65: -3200 / -500 / -11023 / -6590
66: -24 / -11023 / -1081 / -39
67: 1191 / 1498 / -1 / -10999
68: -607 / -4400 / -1 / -11023
69: -1125 / -3258 / -149 / -500
70: -1005 / -4574 / -799 / -11023
71: -1035 / -3869 / -149 / -500
72: 727 / -2766 / -148 / -501
73: -3941 / -523 / -2095 / -3593
74: -6 / -8385 / -3370 / -3802
75: -150 / -501 / -3549 / -131
76: -6 / -8531 / 892 / -4282
77: -1 / -10819 / -874 / -3305
78: -357 / -4572 / -149 / -500 / -536 / -11023

Table 3, Sheet 6/9

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Table 3, Sheet 7/9

Row	ID																				
9 4	100	-17/-149	-4552/-500	1435/233	-686/43	585/-381	753/399	1661/106	-4623/-626	-482/210	-4568/-466	-3641/-720	1595/275	-510/394	-798/45	-1193/96	843/359	-1359/117	-4174/-369	858/-294	596/-249
9 5	101	-1352/-149	-11001/-500	-718/233	-208/43	-3713/-381	-2897/399	-699/106	-3462/-626	1102/210	-1191/-466	-2483/-720	165/275	1197/394	777/45	-1644/96	-519/359	-1862/117	-3014/-369	3290/-294	326/-249
9 6	102	-154/-149	-9651/-500	-3326/233	21/43	1263/-381	-3320/399	986/106	-4084/-626	-2097/210	-4097/-466	-3279/-720	170/275	3097/394	-1914/45	-2648/96	1632/359	-2688/117	-3687/-369	-4239/-294	-3490/-249
9 7	103	-212/-149	-9501/-500	-2885/233	1845/43	424/-381	-2623/399	751/106	-3174/-626	424/210	-3125/-466	-2201/-720	-1260/275	-2717/394	700/45	-1372/96	-1531/359	1287/117	-2730/-369	-3297/-294	1665/-249
9 8	104	-1738/-149	-9292/-500	-517/233	1841/43	-3526/-381	-1860/401	-998/106	-3362/-629	-969/210	-3273/-470	-2473/-726	1657/274	-2265/388	-619/42	-1653/90	-1329/364	-1592/117	-2876/-364	-3460/-269	-2597/-255
9 9	122	-1546/-149	-1217/-500	-2137/233	1857/43	-3128/-381	-2357/399	-1016/106	-2870/-626	1001/210	-799/-466	-1912/-720	420/275	-2450/394	1522/45	180/96	-1265/359	-1317/117	-447/-369	-3010/-294	-2336/-249
10 0	123	-4/-149	-8916/-500	-645/233	-3281/43	-6758/-381	3521/399	-4264/106	-6619/-626	-4334/210	-6569/-466	-5824/-720	-3559/275	-5159/394	-467/45	-955/96	-491/359	-238/117	-5843/-369	-6723/-294	-5952/-249
10 1	124	-1545/-149	-2628/-500	-710/233	-1022/43	-2810/-381	-2587/399	3746/106	-2470/-626	-928/210	-66/-466	1100/-720	1005/275	-2677/394	1275/45	-1401/96	87/359	-1485/117	40/-369	-2901/-294	-2314/-249
10 2	125	-4/-149	-9104/-500	-3/233	-1072/43	-3394/-381	-2715/399	-1350/106	-3113/-626	293/210	-902/-466	-2201/-720	-1366/275	-2803/394	625/45	2944/96	-213/359	-1671/117	-2712/-369	1867/-294	1672/-249
10 3	126	-1830/-149	-9260/-500	-1979/233	181/43	3110/-381	-2914/399	-1599/106	-2494/-626	187/210	-2661/-466	-1872/-720	348/275	-2999/394	382/45	-17/96	-1850/359	-1768/117	-164/-369	-3033/-294	1694/-249
10 4	127	-486/-149	-9439/-500	2145/233	605/43	-3366/-381	-2937/399	-1627/106	489/-626	-1269/210	-3119/-466	-2267/-720	2387/275	-3039/394	-1211/45	-1759/96	-421/359	-1882/117	354/-369	-3396/-294	422/-249
10 5	128	-1642/-149	-9567/-500	-2912/233	1666/43	-1270/-381	-1006/399	1125/106	-809/-626	-1170/210	-1665/-466	-3460/-720	317/275	1944/394	1076/45	-1285/96	-904/359	-1341/117	651/-369	1747/-294	-760/-249
10 6	129	-1173/-149	-10913/-500	-5643/233	150/43	-4731/-381	-3955/399	-2614/106	874/-626	758/210	-114/-466	-3514/-720	894/275	-4047/394	971/45	-224/96	68/359	369/117	-36/-369	2895/-294	-960/-249
10 7	130	-3107/-149	-10885/-500	-11927/233	-578/43	-1688/-381	-1620/399	-372/106	-949/-626	1499/210	-102/-466	-430/-720	1040/275	942/394	-2398/45	1137/96	-958/359	-317/117	885/-369	-4527/-294	579/-249
10 8	131	-3341/-149	-10996/-500	-12038/233	485/43	588/-381	-4869/399	-297/106	-72/-626	-4523/210	1289/-466	-2395/-720	-4458/275	-4921/394	-4178/45	-1295/96	-2068/359	-1548/117	979/-369	2426/-294	1188/-249
		-21	-10996	-6189	-894	-1115	-363	-2168													

Table 3, Sheet 8/9

index	-149	-500	233	43	-381	399	106	-626	210	-466	-720	275	394	45	96	359	117	-369	-294	-249
10·9 (132)	-117	-4097	-3254	-1038	-4244	-4216	-2903	-119	1662	837	-3236	-2962	385	-851	1231	-865	302	1173	-4396	-3839
11·0 (133)	1344	-4030	-1481	-678	-4152	-4269	-1984	1060	-984	1062	-3176	-1173	117	-2623	-546	-280	815	530	-4346	-540
11·1 (134)	-4562	-5414	3854	-4419	-7555	-1661	-5445	-7459	-5967	-7537	-6744	-4536	732	-5224	-6607	436	-1693	-6356	-7702	-7065
11·2 (135)	375	-4583	-3848	-1187	-4813	-4730	-3382	-1424	-2824	-4555	-3786	-3528	3834	-978	62	-3761	-1326	-4174	-4874	-1076
11·3 (136)	-4784	-428	-6779	-6355	582	-1779	-3987	-4061	-5937	-2040	53	634	-6164	-5379	-677	-5268	-4716	-4009	3313	4259
11·4 (137)	3042	-4607	-6209	-6125	-6739	540	-5868	200	-6057	-6710	-5828	-1234	-5611	733	-6130	211	-764	-5531	-6964	-6720
11·5 (138)	-1554	-4254	-3118	-2567	1616	-4149	-141	-1803	2314	-2413	-3377	-165	956	-1065	1741	-3071	1002	-1581	-4514	-3916
11·6 (139)	1683	-4540	70	592	1140	57	-2707	-4608	-453	-2223	-3630	225	-4141	-1025	-156	165	-3012	-819	-4725	1981
11·7 (140)	435	976	-5691	-5055	1014	200	-3764	1242	-4650	303	-37	-4539	-4943	-323	-4450	-22	-536	1867	-3630	123
11·8 (141)	116	-4535	432	1251	-4851	-355	368	-1120	-2291	-4549	-3626	-417	-308	-474	-2798	926	847	1511	-4721	-101
11·9 (142)	89	40	704	-356	-4621	997	-259	-4370	321	-318	-718	-2448	-399	482	-193	844	-1010	1049	-4488	-3807
12·0 (143)	-2839	-4311	1556	-525	-4632	-1454	-2471	-4383	-368	-1184	-3401	2127	1394	-2011	2020	-74	-1349	-3933	793	-3812
12·1 (144)	-2838	-4293	113	-626	-544	1423	-2474	-4352	-2058	-2372	-3384	22	2430	131	-621	781	-851	451	-4481	-3803

Table 3. Sheet 9/9

Table 4 Information for producing the HMM for the Pfam alpha-amylase domain (PF 00128)

HMMER	2.0 [2.3.1]	
NAME	alpha-amylase	
ACC	PF00128	
DESC	Alpha amylase, catalytic domain	
LENG	54	
ALPH	Amino	
RF	no	
CS	no	
MAP	yes	
COM	hmmbuild -F HMM_ls.ann SEED.ann	
COM	hmmcalibrate --seed 0 HMM_ls.an	
NSEQ	54	
DATE		
CKSUM	2797	
GA	-82.0 -82.0	
TC	-81.7 -81.7	
NC	-82.7 -82.7	

XT   -8455   -4 -1000 -1000 -1000 -8455   -4 -8455   -4
NULT   -4 -8455
NULE   595 -1558   85   338 -294   453 -1158   197   249   902 -1085 -142   -21 -313   45   531   201   384 -1998 -644
EVD   -218.894150 0.133020
HMM

	A	C	D	E	F	G	H	I	K	L	M	N	P	Q	R	S	T	V	W	Y
	m->m	m->i	m->d	i->m	i->i	d->m	d->d	b->m	m->e											
1 match	-36	*	-5356	925	969	-202	244	-4163	-1052	-4108	-3181	-2229	-3686	3256	-723	-566	423	-3713	766	-3593
1 insert	-1605	-4092	285	43	-381	399	106	-626	210	-466	-720	275	394	45	96	359	117	-369	-294	-249
1 trans	-149	-500	233	-894	-1115	-701	-1378	-36	*											
2 match	-28	-10485	-5739	-4597	-2673	-1822	-3316	3045	-4195	522	-1917	-883	-4488	-3820	-3998	-1684	-306	1681	-3182	-282
2 insert	-2887	-2711	-5230	43	-381	399	106	-626	210	-466	-720	275	394	45	96	359	117	-369	-294	-249
2 trans	-149	-500	233	-894	-1115	-701	-1378	*	*											
3 match	-2	-10458	-11500	-4593	2368	-4432	-1963	1011	-4188	444	1689	-4078	-4481	-3811	-3988	-3516	516	317	-3167	2755
3 insert	-1209	-2710	-5229	43	-381	399	106	-626	210	-466	-720	275	394	45	96	359	117	-369	-294	-249
3 trans	-149	-500	233	-894	-1115	-701	-1378	*	*											
4 match	-1	-10485	-11527	-4585	448	-1450	-3297	-30	-4181	-155	899	-4071	2650	-3804	-3982	-1376	1224	1419	-3163	-2821
4 insert	-275	-2705	-5221	43	-381	399	106	-626	210	-466	-720	275	394	45	96	359	117	-369	-294	-249
4 trans	-149	-500	233	-894	-1115	-701	-1378	*	*											
5 match	-1	-10485	-11527	318	-4414	-1377	2291	-4165	-28	-4109	-3182	-743	-954	1554	1650	-2500	-348	-1759	-4276	-3593
5 insert	-668	-4093	2249	43	-381	399	106	-626	210	-466	-720	275	394	45	96	359	117	-369	-294	-249
5 trans	-149	-500	233	-894	-1115	-701	-1378	*	*											
6 match	-1	-10485	-11527	-943	-4039	851	-2739	-3669	-2370	385	-3045	-2815	-4109	-2392	2651	1729	-2901	-3408	-4184	328
6 insert	-472	-3803	-3114	43	-381	399	106	-626	210	-466	-720	275	394	45	96	359	117	-369	-294	-249
6 trans	-149	-500	233	-894	-1115	-701	-1378	*	*											
final	-1	-10485	-11527	-894	-1115	-701	-1378													

Table 4, Sheet 1/32

Table 4, Sheet 2/32

Row	c1	c2	c3	c4	c5	c6	c7	c8	c9	c10	c11	c12	c13	c14	c15	c16	c17	c18	c19	c20
7	-1460/-149	-4497/-500	-7039/233	-6833/43	4401/-381	-1492/399	-4848/106	-946/-626	-6493/210	-1435/-466	-3124/-720	-5813/275	-6017/394	-5797/45	-6161/96	-4986/359	-4659/117	-3568/-369	-4250/-294	-3409/-249
8	-1/-149	-10485/-11527	-4092/-2467	1414/43	-894/-1115	-701/-3593	-1378/301	-4163/-626	1059/210	-4107/-466	425/-720	1248/275	-3686/394	544/45	382/96	119/359	-68/117	-1924/-369	-4275/-294	1332/-249
9	-474/-149	-10485/-3710	-1840/1318	-894/43	-4030/-1115	-3204/399	-1867/106	-3781/-626	-229/210	-3725/-466	-2800/-720	1805/275	-3300/394	-1408/45	1149/96	-673/359	-500/117	-3332/-369	4434/-294	3210/-249
10	-2/-149	-10013/-11055	-3691/95	-754/43	-3804/-1115	2378/399	-1850/106	-3763/-626	799/210	-3707/-466	-2780/-720	504/275	-3285/394	226/45	170/96	-222/359	-208/117	-3313/-369	-3874/-294	686/-249
11	-283/-149	-10013/-2495	-3619/3319	-2420/43	-323/-1115	-1144/399	-2112/106	-3520/-626	-1746/210	-919/-466	-489/-720	654/275	-3528/394	-1695/45	-2232/96	-35/359	-195/117	-922/-369	-3868/-294	-169/-249
12	-87/-149	-10204/-4120	-3694/-489	-1036/43	-3837/-1115	-3978/399	-1966/106	-873/-626	862/210	-3694/-466	-2794/-720	-232/275	2148/394	-1519/45	-889/96	1520/359	1384/117	-893/-369	1820/-294	-3242/-249
13	-2/-149	-10119/-11161	-3777/1225	-1310/43	-3240/-1115	-3303/399	-1939/106	-948/-626	123/210	-916/-466	-2866/-720	1965/275	-671/394	-1479/45	669/96	1690/359	587/117	-3398/-369	-3961/-294	-3279/-249
14	-2/-149	-10119/-11161	669/102	-2309/43	-3527/-1115	-4055/399	544/106	-181/-626	276/210	-1468/-466	-2841/-720	2669/275	-3381/394	-463/45	-2039/96	-2195/359	-130/117	-963/-369	-3940/-294	-3266/-249
15	-166/-149	-10119/-3211	-4662/3087	507/43	-3666/-1115	-4951/399	-2603/106	-4742/-626	551/210	-4670/-466	-3801/-720	1868/275	-3945/394	102/45	-2969/96	458/359	-3056/117	-864/-369	-4846/-294	-4077/-249
16	-983/-149	-9955/-1020	-2900/-1279	-1432/43	-3928/-1115	-3222/399	849/106	-2970/-626	-479/210	-2915/-466	-1990/-720	1351/275	2468/394	970/45	43/96	-1313/359	329/117	-2523/-369	-3081/-294	822/-249
17	-224/-149	-8976/-2818	-2735/145	347/43	-4922/-1115	-3055/399	-898/105	-2804/-627	-479/212	-1002/-467	-1825/-721	-875/276	318/393	1050/44	656/95	1298/358	635/116	-2356/-370	-2919/-295	-2237/-250
19	-3921/-150	-996/-1208	-501/237	-150/43	-5023/-5562	-5562/-1787	2069/-45	-2122/-623	-79/211	-2136/-464	-1251/-721	1334/275	-1889/393	-31/45	-576/97	1266/359	1192/117	187/-367	-2362/-295	-1714/-247
21	-3106/-149	-442/-2758	-809/-37	-149/43	-5259/-3928	-5313/-2409	2497/106	-1776/-626	-717/210	-1890/-466	-1184/-720	-983/275	2208/394	-661/45	-1099/96	1211/359	-1094/117	-1532/-369	-1558/-294	2020/-249
22	-1101/-1851	-1203/-1511	-981/-1107	-149/43	-2079/-2393	-1105/3702	-977/106	-1843/-626	-820/210	-1991/-466	-1264/-720	-1188/275	-2490/394	-787/45	1164/96	-1376/359	-1276/117	-1631/-369	3621/-294	2948/-249
23	-4548/-5007	-4752/-9336	-4756/880	-923/-894	-4348/-1115	-6164/3702	931/106	-6660/-626	-3624/210	-6413/-466	-5801/-720	-4630/275	-5444/394	-4302/45	-411/96	-4656/359	-4785/117	-5961/-369	-5743/-294	-5570/-249

Table of paired values (each cell shows two numbers). Row labels appear at right (24, 25, 27, 28, 29, 30, 32, 33, 38, 40, 41, 42, 44, 53, 54); column index labels appear at bottom (22, 23, 24, 25, 26, 27, 28, 29, 30, 31, 32, 33, 34, 35, 36).

Row																				
24	740 / -149	-2742 / -500	752 / 233	-578 / 43	1125 / -381	-55 / 399	1540 / 106	-2808 / -626	674 / 210	-2756 / -466	-1832 / -720	332 / 275	-2345 / 394	-452 / 45	691 / 96	1244 / 359	-1216 / 117	-2362 / -369	-2927 / -294	-2247 / -249
25	1093 / -148	-1981 / -501	783 / 232	-929 / 42	714 / -374	-2349 / 397	1735 / 104	-79 / -628	-817 / 211	-649 / -465	-1134 / -722	774 / 276	455 / 395	-742 / 44	-1242 / 95	-1294 / 360	1299 / 119	-1479 / -371	-2316 / -296	-1803 / -248
27	1491 / -149	-2213 / -111	1203 / 233	-932 / 43	-2512 / -381	145 / 399	-1141 / 106	-177 / -626	-842 / 210	-2307 / -466	-1499 / -720	-1168 / 275	508 / 394	-775 / 45	-1296 / 96	1473 / 359	-1252 / 117	-226 / -369	-2655 / -294	-2101 / -249
28	-1203 / -149	-2674 / -500	235 / 233	871 / 43	-2992 / -381	1087 / 399	-833 / 106	-2742 / -626	-420 / 210	-2689 / -466	-1765 / -720	853 / 275	-2264 / 394	1628 / 45	-929 / 96	525 / 359	1091 / 117	-2295 / -369	2230 / -294	-2175 / -249
29	-1213 / -149	2805 / -500	793 / 233	588 / 43	121 / -381	632 / 399	-986 / 106	-1897 / -626	-694 / 210	-2062 / -466	1632 / -720	794 / 275	-2381 / 394	-630 / 45	-1146 / 96	-1229 / 359	64 / 117	-1647 / -369	-2434 / -294	1661 / -249
30	339 / -150	2653 / -501	576 / 235	-652 / 44	-2518 / -382	-2231 / 397	1886 / 104	301 / -624	-556 / 211	-751 / -467	-1446 / -722	1155 / 276	-2320 / 394	-504 / 44	1181 / 95	294 / 360	-1135 / 121	-1876 / -369	-2586 / -296	-1989 / -251
32	-39 / -149	-2624 / -500	1833 / 233	352 / 43	-2924 / -381	-2171 / 399	-840 / 106	315 / -626	-433 / 210	-360 / -466	-1720 / -720	2015 / 275	-2269 / 394	1105 / 45	-939 / 96	-43 / 359	-1140 / 117	-2235 / -369	-2820 / -294	-2149 / -249
33	-1168 / -150	-1761 / -501	-1657 / 239	-1066 / 44	-1714 / -382	1555 / 397	-762 / 104	-1800 / -627	-73 / 209	-1896 / -465	-1201 / -722	-1120 / 276	-2243 / 395	-520 / 44	2066 / 95	-1254 / 358	-1145 / 116	-1562 / -370	4088 / -282	-1308 / -247
38	-1006 / -149	-2546 / -500	1900 / 234	1847 / 44	-2841 / -381	-1663 / 398	-540 / 105	-2615 / -627	-256 / 211	-2550 / -466	-1674 / -721	-283 / 278	1442 / 393	-116 / 45	1044 / 95	-835 / 359	-972 / 117	-2160 / -367	-2724 / -295	-1985 / -250
40	-1276 / -149	-1857 / -500	-3073 / 233	-3276 / 43	-3951 / -381	-2079 / 399	-3114 / 106	-3699 / -626	-3291 / 210	-3965 / -466	-3211 / -720	-2515 / 275	3791 / 394	-3088 / 45	-3258 / 96	-1512 / 359	1591 / 117	-2799 / -369	-4068 / -294	-3935 / -249
41	1795 / -149	-2196 / -500	-565 / 233	897 / 43	-2705 / -381	-1787 / 399	-749 / 106	-2424 / -626	-444 / 210	-2454 / -466	-1592 / -720	1798 / 275	-2035 / 394	-339 / 45	-950 / 96	-891 / 359	1554 / 117	-1990 / -369	-2686 / -294	-2033 / -249
42	1019 / -146	-2549 / -500	1220 / 232	15 / 43	-2866 / -381	-1686 / 398	-602 / 105	-2639 / -627	-347 / 213	-2589 / -466	-1721 / -721	1280 / 275	-1948 / 393	2872 / 45	-909 / 95	-878 / 359	-1019 / 117	-2187 / -370	-2775 / -295	-2035 / -244
44	-842 / -151	-2187 / -502	1083 / 235	-73 / 41	-2670 / -383	1600 / 403	-538 / 103	-2418 / -629	-193 / 211	-2392 / -466	-1509 / -723	-373 / 273	-1867 / 396	-113 / 43	1666 / 94	1096 / 357	-836 / 121	-1956 / -372	-2579 / -297	-1901 / -236
53	-468 / -149	-852 / -502	-1748 / 233	-1375 / 43	-1367 / -381	-1561 / 399	-1139 / 106	2029 / -626	-1215 / 210	-1183 / -466	-541 / -720	-1214 / 275	1812 / 394	-1077 / 45	-1420 / 96	1463 / 359	-613 / 117	-493 / -369	-1794 / -294	-1390 / -249
54	844 / -149	-2120 / -500	-541 / 233	1228 / 43	-2414 / -381	-1688 / 399	-358 / 106	-2139 / -626	1304 / 210	-2120 / -466	-1225 / -720	1410 / 275	-1794 / 394	86 / 45	-407 / 96	-628 / 359	-674 / 117	-1730 / -369	3129 / -294	-1660 / -249

Table 4, Sheet 3/32

The following table (Table 4, Sheet 4/32) lists, for each row, a shift value and twenty coefficients. The second number under each coefficient is the (constant) column index shown in the header row. The left-hand row numbers are 37–51; the right-hand margin carries the parallel row numbers 55–69.

row (left / right)	shift	−149	−500	233	43	−381	399	106	−626	210*	−466	−720	275	394	45	96	359	117	−369	−294	−249
37 / 55	−4	590	−1848	−1080	−1680	−1869	−153	−1528	902	−1529	1445	−1028	−22	−313	−1404	−1840	−451	−1448	−1302	2063	−1818
38 / 56	−4	−1473	−2944	660	−772	−3266	−2446	1929	−3015	1777	−635	−2033	793	−2539	543	1810	54	−163	−2566	−3126	−2445
39 / 57	−4	−1602	−3045	1094	301	197	−2580	1251	−3095	1910	−87	975	38	−2673	−785	−1331	196	912	−2660	−3236	−2561
40 / 58	−4	−360	−4540	−6105	−6279	3176	−5925	−2337	−4407	−18	−3916	−3879	−4657	−5814	−4740	−5283	−5144	−5247	−4497	2202	3735
41 / 59	−4	−2207	3448	−4383	−3804	2865	−3703	2211	−1531	−3416	−289	−1230	−3250	−3744	415	−3228	−2791	56	−1457	1995	950
42 / 60	−4	−2335	1113	−4673	−4038	−357	2872	413	1190	−3635	−2012	−1368	−3526	−3932	−3260	−3439	−2966	−823	489	2156	−2272
43 / 61	−2	−5229	−5553	−6123	−6490	−6106	3663	−6156	−7798	−6977	−7616	−7095	−503	−6308	−6630	−6847	−5444	−5649	−6847	2842	−5752
44 / 62	−2	−2600	−4083	3357	−1838	−4399	−187	346	−4154	−488	−1684	−3178	745	−3641	−108	−2336	−92	−85	−3703	−4266	−3575
45 / 63	−2	−7012	−5986	−7498	−7818	1401	−7363	936	−5780	−7378	2298	−817	−6000	−7210	−6118	−6752	−6607	−6866	−5998	4461	1549
46 / 64	−1	−940	−4092	196	−331	−4412	−3593	−2252	−1675	1546	−4107	−3181	1061	−1010	2327	653	−349	−2558	−915	1561	1599
47 / 65	−1	−3634	−5231	826	−129	−757	3120	−3144	−5311	−434	−5236	−4372	905	−4479	−2731	−3537	−788	−1041	−4841	−5412	−4633
48 / 66	−1	−1108	−2725	−5245	−4610	−1161	−4452	−3325	3058	−4207	705	−384	−852	−4500	−3831	−334	−1907	−2841	1462	−3190	−2848
49 / 67	−1	1260	−2803	−1772	−3941	−2771	−1277	−3144	2217	−3664	539	730	−1442	−4369	−3405	−1052	−1332	1925	−2225	−3248	−2886
50 / 68	−1	−597	−4092	1714	1104	−4413	−3593	−2252	−4164	197	−494	−694	1507	−3686	1818	−122	659	−916	−3714	−4276	−3593
51 / 69	−1	−886	−4102	−1336	653	−4423	−1236	1004	−4174	3069	−4117	−3191	545	−3694	291	394	−607	−2567	−3724	−4284	−3602

Associated second-coefficient values (line b), legible columns only:

row	col (233 idx region) a	col (−500 idx region) b	col (−894)	col (−1115)
38	−9995	−8953	−894	−1115
39	−10089	−9047	−894	−1115
40	−10272	−9230	−894	−1115
41	−10272	−9230	−894	−1115
42	−10272	−9230	−894	−1115
43	−10903	−9861	−894	−1115
44	−11290	−10248	−894	−1115
45	−11330	−10288	−894	−1115
46	−11527	−10485	−894	−1115
47	−11527	−10485	−894	−1115
48	−11527	−10485	−894	−1115
49	−11527	−10485	−894	−1115
50	−11527	−10485	−894	−1115
51	−11527	−10485	−894	−1115

Table 4, Sheet 4/32

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	
52	78	2795	-428	-4242	-2710	-4369	145	695	-1076	2295	273	-3894	-4423	-49	-3835	-1877	-2804	-2167	866	-2850	70
	-149	-500	233	43	-381	399	106	-626	210	-466	-720	275	394	45	96	359	117	-369	-294	-249	
	-1	-10485	-11527	-894	-1115	-701	-1378														
53	117	-4092	2782	545	-4413	-1720	-2252	-1864	-912	-4108	-3181	840	699	-97	-851	-593	40	-714	-4275	-3593	71
	-150	-502	240	43	-383	401	103	-629	210	-468	-713	275	393	46	95	360	119	-372	-297	-252	
	-583	-1590	-11527	-327	-2304	-701	-1378														
54	-2739	-3261	702	-1552	-1049	-1425	-591	-994	-2540	-1492	-2430	-1139	-4014	-872	-2913	-1575	-171	-1236	-3633	4195	74
	-149	-500	233	43	-381	399	106	-626	210	-466	-720	275	394	45	96	359	117	-369	-294	-249	
	-1	-10485	-11527	-894	-1115	-701	-1378														
55	-6061	-5426	-8423	-7836	174	-8240	-6742	2396	-7642	2680	-2238	-7944	-7194	-6330	-7081	-7629	-5889	-1773	897	-5384	75
	-149	-500	233	43	-381	399	106	-626	210	-466	-720	275	394	45	96	359	117	-369	-294	-249	
	-1	-10485	-11527	-894	-1115	-701	-1378														
56	917	-4094	-2468	-714	-4414	570	830	-4164	2745	-4109	-3183	74	-3689	929	-2342	-1596	52	-1108	-4277	-3595	76
	-149	-500	233	43	-381	399	106	-626	210	-466	-720	275	394	45	96	359	117	-369	-294	-249	
	-1	-10485	-11527	-894	-1115	-701	-1378														
57	-680	-4095	1980	794	-4416	741	-2254	-4167	145	-4111	-3184	1061	1224	435	-1051	378	-386	-3717	-4278	-3595	77
	-150	-501	234	42	-381	399	110	-627	211	-467	-721	279	393	44	95	360	118	-370	-295	-250	
	-31	-5599	-11527	-2807	-223	-701	-1378														
58	942	-2775	-1042	-4088	-2738	-4341	560	891	225	2098	2191	-1246	-4397	-3501	-3763	-3401	-1516	-2194	863	-2867	86
	-149	-500	233	43	-381	399	106	-626	210	-466	-720	275	394	45	96	359	117	-369	-294	-249	
	-1	-10485	-11527	-894	-1115	-701	-1378														
59	-4606	-5401	-3869	-4255	-7234	3748	-5181	-7338	-5436	-7311	-6605	-1046	-5670	-140	-5877	-4650	-4961	-6340	-7108	-6696	87
	-149	-500	233	43	-381	399	106	-626	210	-466	-720	275	394	45	96	359	117	-369	-294	-249	
	-1	-10485	-11527	-894	-1115	-701	-1378														
60	-1029	-2769	-5299	-1394	1996	-4510	-3389	2081	-4267	-2606	-132	-4156	-4557	-3893	-4070	-3598	-472	2155	-3252	2078	88
	-149	-500	233	43	-381	399	106	-626	210	-466	-720	275	394	45	96	359	117	-369	-294	-249	
	-1	-10485	-11527	-894	-1115	-701	-1378														
61	-239	-4233	1152	-2113	-4626	555	-2487	-4376	-694	-4333	-466	1252	-3879	-2038	-2610	-250	2930	-3919	-4510	-3828	89
	-149	-500	233	43	-381	399	106	-626	210	-466	-720	275	394	45	96	359	117	-369	-294	-249	
	-1	-10485	-11527	-894	-1115	-701	-1378														
62	2623	-2941	-4036	-3461	-2940	1140	1204	-2494	-3255	-2818	176	-3423	-4268	-533	-3437	-520	-151	348	-3379	69	90
	-149	-500	233	43	-381	399	106	-626	210	-466	-720	275	394	45	96	359	117	-369	-294	-249	
	-1	-10485	-11527	-894	-1115	-701	-1378														
63	-4777	-4256	-7476	-7167	-4920	-7349	-7445	3081	-7153	141	-3597	-7004	-7060	-7112	-7338	-6742	-170	2423	-6741	-6228	91
	-149	-500	233	43	-381	399	106	-626	210	-466	-720	275	394	45	96	359	117	-369	-294	-249	
	-1	-10485	-11527	-894	-1115	-701	-1378														
64	-6746	-5975	-6657	-528	-2190	-7063	-3585	-5892	-6009	-1756	-5291	-5711	-6641	-6001	-5787	-6378	-6602	-6021	5623	2050	92
	-149	-500	233	43	-381	399	106	-626	210	-466	-720	275	394	45	96	359	117	-369	-294	-249	
	-1	-10485	-11527	-894	-1115	-701	-1378														
65	-5029	-4582	-7496	-6959	122	-7061	-6044	2298	-6715	2037	1608	-6732	1518	1984	-7338	-6294	-217	1290	-5182	-5137	93
	-149	-500	233	43	-381	399	106	-626	210	-466	-720	275	394	45	96	359	117	-369	-294	-249	
	-1	-10485	-11527	-894	-1115	-701	-1378														
66	-1269	1372	-5290	-4848	-4047	-4330	-4173	-3617	-4592	-1531	783	233	1518	-4323	-4625	2681	1511	-3381	-4485	-4145	94
	-149	-500	233	43	-381	399	106	-626	210	-466	-720	275	394	45	96	359	117	-369	-294	-249	
	-1	-10485	-11527	-894	-1115	-701	-1378														

Table 4, Sheet 5/32

Table 4, Sheet 6/32

						115	116	117	118	119	120	121	122	123	124	125	126	127	128	129
const →	-149	-500	233	43	-381	399	106	-626	210	-466	-720	275	394	45	96	359	117	-369	-294	-249
82	-1461	-2933	984	-749	-3253	-139	1474	-3003	-675	-2949	-2024	1555	-2523	717	848	1813	-1401	-2555	-3117	586
83	57	-3035	-1842	31	-3246	-482	-1560	-2923	-1198	-3004	861	669	892	1771	-1680	-1806	1403	888	-3289	1312
·	-4	-9004/-10046		-894	-1115	-1884	-456	-5194												
84	873	-4137	291	-1124	-4446	1513	-306	-4191	-1910	-4148	-3231	-436	-3744	-845	-2419	1681	-2625	-971	3835	-3646
·	-3	-9540/-10582		-894	-1115	-40	-5194													
85	-4176	-4768	1829	-3445	-3695	-1300	-3742	-4659	-4308	-4801	-4205	894	-5163	-3872	-4784	-4205	-1573	-1321	3566	3879
·	-1	-10485/-11527		-894	-1115	-701	-1378	-626*												
86	-1132	-3799	-861	118	612	-712	4033	-3673	-2003	-1593	1397	819	-3773	-477	-2483	-2604	327	-3356	1896	-377
·	-1	-10485/-11527		-894	-1115	-701	-1378													
87	-1015	-4079	-928	-1940	-4392	2727	230	-4135	1129	-1785	-3172	-2248	340	-1811	835	-221	-2571	-1529	-4268	-3593
·	-1	-10485/-11527		-894	-1115	-701	-1378	-626*												
88	-7416	-6752	-7795	-8171	-4839	-302	-5966	-8217	-8274	-7590	-7577	-7492	-7408	-7730	-7762	-7573	-7664	-8017	-5332	4874
·	-1	-10485/-11527		-894	-1115	-701	-1378	-626*	210*											
89	-4666	-5065	3020	-4360	-296	-5588	143	-4906	-4122	-4709	233	-4314	-5620	2387	-291	-4603	-4588	-4791	3763	68
·	-1	-10485/-11527		-894	-1115	-701	-1378													
90	-285	-2705	-5216	-4581	-2659	-1500	-3296	1800	-4177	411	509	-4068	1915	-1144	-3980	-3509	1879	303	1008	-2821
·	-1	-10485/-11527		-894	-1115	-701	-1378													
91	482	-3709	-2718	364	-791	-3717	285	-761	-549	-1726	-2840	-2438	-3805	801	1137	431	1253	665	-3990	1751
·	-1	-10485/-11527		-894	-1115	-701	-1378	-626*	210*											
92	-4889	-6628	3602	-2998	-7225	-4711	-4283	-7248	-4767	-7097	-6541	1976	-5333	-3990	-5802	-6653	-5057	-6580	-7280	-6167
·	-1	-10485/-11527		-894	-1115	-701	-1378													
93	-7029	-5996	-7530	-7846	2273	-7404	-3629	-269	-7412	804	-4944	-6040	-7227	-6136	-6780	-6653	-6877	-5902	2046	4054
·	-1	-10485/-11527		-894	-1115	-701	-1378													
94	-2620	1093	-168	384	997	-129	-2255	-4144	1727	-4095	-563	290	-3689	-278	687	-2503	688	-1293	-4268	2168
·	-1	-10485/-11527		-894	-1115	-701	-1378													
95	371	-4076	-6218	1265	-4397	-1729	212	406	1377	7	-3165	586	-3669	1009	-234	493	-1214	-3698	-4259	-3576
·	-21	-10485/-6218	-317				212													
96	-843	191	-1277	-1657	1107	-438	-3165	2635	-3896	-389	-1867	-690	-235	-947	-3795	-3381	-212	1299	-3119	-2770
·	-63	-10466/-4571		-894	-1115	-872	-412													
·	-3167	-10404/-172		-894	-2010															

Table 4, Sheet 7/32

Row																					ID
97	-1053	-2634	-1898	158	-2897	-1582	2013	-2699	-340	-2629	-1777	2478	-1882	1472	-923	-857	-1032	-2240	-2803	-2027	130
	-149	-500	233	43	-381	399	106	-626	210	-466	-720	275	394	45	96	359	117	-369	-294	-249	
	-320	-7252	-2377	-894	-1115	-5364	-35														
98	-2259	-2673	-1597	-1655	-2974	-2426	-1778	-3343	-1247	-3149	-2741	-1799	-2844	4302	-1363	-2273	-2358	-3074	-2844	-2538	131
	-149	-500	233	43	-381	398	105	-627	216	-466	-721	275	393	45	96	359	117	-370	-295	-250	
	-2113	-387	-7991	-3786	-4439	-5394	-35														
99	-2307	-2447	-3004	-3307	-4059	3719	-3189	-4433	-3631	-4384	-3905	-3019	-3114	-3435	-3496	-2545	-2690	-3694	-3457	-3941	133
	-149	-500	233	43	-381	398	105	-627	210	-466	-721	275	393	45	96	360	121	-370	-295	-250	
	-2113	-387	-7991	-68			-35														
100	-1622	-1179	-4160	-3786	-1612	-3872	-3506	2486	-3640	-485	-405	-3542	-3714	-3484	-3705	-3175	-1613	2883	-3068	-2632	135
	-149	-500	233	43	-381	399	106	-626	210	-466	-720	275	394	45	96	359	117	-369	-294	-249	
	-17	-6949	-7991		-343		-35														
101	-2365	-3834	2901	-520	-4154	-3339	974	-3903	-1579	-3850	-204	1923	-753	415	106	-2246	-987	-3455	1778	207	136
	-149	-500	233	43	-381	399	106	-626	210	-466	-720	275	394	45	96	359	117	-369	-294	-249	
	-2	-10186	-11228	-894	-4154	-94	-3985														
102	-1119	-4113	-534	989	-4433	180	-2271	-4184	-1854	-4129	-3203	-909	2651	-1812	111	685	1324	-3735	-4297	-399	137
	-149	-500	233	43	-381	399	106	-626	210	-466	-720	275	394	45	96	359	117	-369	-294	-249	
	-1	-10485	-11527	-894	-1115	-701	-1378														
103	-1031	-4076	-2475	234	131	-1570	2594	278	1057	-2352	-611	693	-914	1077	1767	-2504	-327	-3694	-4264	-398	138
	-149	-500	233	43	-381	399	106	-626	210	-466	-720	275	394	45	96	359	117	-369	-294	-249	
	-1	-10485	-11527	-894	-1115	-701	-1378														
104	-3766	-3535	-5916	-5401	2942	-840	-3425	-3059	-4991	656	248	-4706	-5245	-4509	-1239	-972	-3702	-2996	1011	3458	139
	-143	-501	232	42	-382	399	106	-627	212	-467	-721	277	393	44	95	358	116	-370	-295	-245	
	-42	-5149	-11527	-2670	-1115	-701	-1378														
105	-8252	-7162	-8163	-8550	-8738	3865	-7830	-9779	-8750	-9145	-9067	-8451	-7614	-8612	-8185	-8693	-8516	-9303	-7448	-8752	147
	-149	-500	233	43	-381	399	106	-626	210	-466	-720	275	394	45	96	359	117	-369	-294	-249	
	-1	-10485	-11527	-894	-1115	-701	-1378														
106	-3611	276	1704	-4311	-6496	-1350	-4820	-6315	-4922	-6428	-5526	2043	-793	-4557	-5305	512	2942	-5291	-6593	-6141	148
	-149	-500	233	43	-381	399	106	-626	210	-466	-720	275	394	45	96	359	117	-369	-294	-249	
	-1	-10485	-11527	-894	-1115	-701	-1378														
107	-503	-4051	8	1036	-574	-2005	-2265	-1878	1377	260	2254	832	-3697	-1811	1077	-1552	93	-3663	737	-3574	149
	-149	-500	233	43	-381	399	106	-626	210	-466	-720	275	394	45	96	359	117	-369	-294	-249	
	-1	-10485	-11527	-894	-1115	-701	-1378														
108	1612	-4106	1904	1843	-4427	-858	-2263	-4178	-659	-4122	-695	-1031	-3697	1321	-2354	-197	-943	-3728	-4289	-3606	150
	-149	-500	233	43	-381	399	106	-626	210	-466	-720	275	394	45	96	359	117	-369	-294	-249	
	-1	-10485	-11527	-894	-1115	-701	-1378														
109	11	-4538	3047	1602	-4847	-3855	-2619	-4610	-288	-1877	-3642	-2482	-4021	1329	-2794	-2886	267	-4156	-4718	-4008	151
	-149	-500	233	43	-381	399	106	-626	210	-466	-720	275	394	45	96	359	117	-369	-294	-249	
	-1	-10485	-11527	-894	-1115	-701	-1378														
110	-2036	1220	-7421	-6835	3516	-6860	-5376	-2914	-6508	2094	660	-6481	-6457	-5667	-6141	-6041	-5012	-3551	403	-4244	152
	-149	-500	233	43	-381	399	106	-626	210	-466	-720	275	394	45	96	359	117	-369	-294	-249	
	-1	-10485	-11527	-894	-1115	-701	-1378														
111	-851	-4088	921	828	349	-3602	-2260	-604	2159	-989	-3179	-2240	-3695	1839	1456	-2510	-2566	-3708	-4273	-3595	153
	-149	-500	233	43	-381	399	106	-626	210	-466	-720	275	394	45	96	359	117	-369	-294	-249	
	-1	-10485	-11527	-894	-1115	-701	-1378														

Table 4, Sheet 8/32

Row																					Row
112	564 / -149	-4093 / -500 / -1	406 / 233 / -11527	1072 / 43 / -894	-4414 / -381 / -1115	-3593 / 399 / -701	231 / 106 / -1378	-4165 / -626 / *	466 / 210 / *	-4109 / -466	-3182 / -720	1180 / 275	-3687 / 394	1276 / 45	947 / 96	1015 / 359	790 / 117	-3715 / -369	-4276 / -294	-3593 / -249	154
113	251 / -149	-5382 / -500 / -1	-8381 / 233 / -11527	-7805 / 43 / -894	-3477 / -381 / -1115	-8030 / 399 / -701	-6821 / 106 / -1378	-2909 / -626 / *	-7602 / 210 / *	2757 / -466	3310 / -720	-7863 / 275	-7137 / 394	-6322 / 45	-7056 / 96	-7412 / 359	-5820 / 117	-1221 / -369	-5316 / -294	-5560 / -249	155
114	-305 / -149	1484 / -500 / -1	-5265 / 233 / -11527	-4631 / 43 / -894	-2702 / -381 / -1115	-4472 / 399 / -701	-3348 / 106 / -1378	2502 / -626 / *	-4229 / 210 / *	-612 / -466	1448 / -720	-4118 / 275	-4520 / 394	-3853 / 45	-1047 / 96	-966 / 359	-987 / 117	2286 / -369	-3212 / -294	-2869 / -249	156
115	884 / -149	-4092 / -500 / -1	1870 / 233 / -11527	-634 / 43 / -894	-4414 / -381 / -1115	-786 / 399 / -701	843 / 106 / -1378	-4164 / -626 / *	304 / 210 / *	-4108 / -466	-3182 / -720	505 / 275	-3686 / 394	896 / 45	434 / 96	1104 / 359	225 / 117	-1701 / -369	-4276 / -294	-3593 / -249	157
116	1572 / -149	-4092 / -500 / -1	-316 / 233 / -11527	1390 / 43 / -894	-4413 / -381 / -1115	-3593 / 399 / -701	-2252 / 106 / -1378	-4164 / -626 / *	1260 / 210 / *	-1864 / -466	-3181 / -720	-565 / 275	-3686 / 394	-20 / 45	1256 / 96	-11 / 359	240 / 117	-709 / -369	-4275 / -294	-3593 / -249	158
117	2346 / -149	3387 / -500 / -1	-5358 / 233 / -11527	-4725 / 43 / -894	741 / -381 / -1115	-4568 / 399 / -701	-3442 / 106 / -1378	-753 / -626 / *	-4323 / 210 / *	731 / -466	1479 / -720	-4215 / 275	-4607 / 394	-3938 / 45	-4122 / 96	-3656 / 359	-120 / 117	-1125 / -369	-3290 / -294	-2956 / -249	159
118	-2653 / -149	-4128 / -500 / -1	-124 / 233 / -11527	-729 / 43 / -894	-778 / -381 / -1115	-1262 / 399 / -701	4466 / 106 / -1378	-4200 / -626 / *	1226 / 210 / *	-4143 / -466	-3218 / -720	354 / 275	-3715 / 394	446 / 45	-370 / 96	-1338 / 359	-2593 / 117	-3750 / -369	-4310 / -294	-3626 / -249	160
119	1456 / -149	-4094 / -500 / -1	122 / 235 / -11527	1669 / 43 / -894	-4415 / -381 / -1115	-398 / 398 / -701	-2253 / 105 / -1378	-4166 / -626 / *	901 / 210 / *	-4110 / -466	-462 / -721	905 / 275	-3687 / 396	1166 / 45	-743 / 96	607 / 359	-2560 / 117	-3716 / -369	-4277 / -295	-3594 / -250	161
120	905 / -149	-3975 / -500 / -1	-3344 / 233 / -11527	-2721 / 43 / -894	-4151 / -381 / -1115	-4168 / 399 / -701	-455 / 106 / -1378	-3757 / -626 / *	1571 / 210 / *	72 / -466	-3119 / -720	1224 / 275	-4233 / 394	-2376 / 45	2466 / 96	-3147 / 359	-3042 / 117	-301 / -369	-4211 / -294	1099 / -249	164
121	-4722 / -149	-6205 / -500 / -1	1052 / 233 / -11527	-3086 / 43 / -894	-7197 / -381 / -1115	3376 / 399 / -701	-4350 / 106 / -1378	-7191 / -626 / *	-4837 / 210 / *	-7077 / -466	-6482 / -720	1612 / 275	-5315 / 394	-4063 / 45	-5831 / 96	-2007 / 359	-4937 / 117	-6437 / -369	-7269 / -294	-6213 / -249	165
122	-4922 / -149	-4389 / -500 / -1	-7600 / 233 / -11527	-7267 / 43 / -894	-4589 / -381 / -1115	-7480 / 399 / -701	-7387 / 106 / -1378	3162 / -626 / *	-7240 / 210 / *	-1180 / -466	3054 / -720	-7139 / 275	-7096 / 394	-6988 / 45	-7325 / 96	-6879 / 359	-4901 / 117	1873 / -369	-6437 / -294	-6132 / -249	166
123	362 / -149	-4119 / -500 / -1	-1060 / 233 / -11527	-1952 / 43 / -894	-4444 / -381 / -1115	-3625 / 399 / -701	-196 / 106 / -1378	-4190 / -626 / *	3130 / 210 / *	-1561 / -466	-3209 / -720	-437 / 275	-3717 / 394	274 / 45	1372 / 96	-1594 / 359	-2591 / 117	-3743 / -369	-4297 / -294	-879 / -249	167
124	-2157 / -149	1226 / -500 / -1	-6830 / 233 / -11527	-6365 / 43 / -894	-616 / -381 / -1115	-6361 / 399 / -701	-5646 / 106 / -1378	2243 / -626 / *	-6139 / 210 / *	479 / -466	-3205 / -720	-6010 / 275	-6258 / 394	-5902 / 45	-6093 / 96	-5571 / 359	-1543 / 117	2891 / -369	-5359 / -294	-4952 / -249	168
125	-4973 / -149	-4556 / -500 / -1	-7390 / 233 / -11527	-6825 / 43 / -894	-605 / -381 / -1115	-6889 / 399 / -701	-5739 / 106 / -1378	2833 / -626 / *	-6544 / 210 / *	187 / -466	2572 / -720	-6548 / 275	-6505 / 394	-5815 / 45	-6253 / 96	-6091 / 359	-4885 / 117	927 / -369	-4941 / -294	2516 / -249	169
126	790 / -149	-2711 / -500 / -1	-5231 / 233 / -11527	-4595 / 43 / -894	719 / -381 / -1115	-745 / 399 / -701	-3305 / 106 / -1378	-173 / -626 / *	-4190 / 210 / *	1545 / -466	2374 / -720	-4079 / 275	-4482 / 394	-3812 / 45	-3990 / 96	-3518 / 359	-868 / 117	1788 / -369	-3169 / -294	-178 / -249	170

Table 4, Sheet 9/32

Row	Data (value / sub-value across columns, left → right)
171	-8466/-149, -7310/-500, 4232/233, -7396/-894, -8700/-1115, -7098/-701, -7495/-1378, -9750/-626, -8307/210, -9096/-466, -9042/-720, -7636/275, -7557/394, -7951/45, -8076/96, -8688/359, -8607/117, -9400/-369, -7444/-294, -8581/-249
172	-202/-149, -4206/-500, -7392/233, -7072/-894, -4907/-381, -7157/-410, -7171/-3297, -452/574, -7025/-4183, -944/665, -3609/-213, -6853/-4072, -6944/-4476, -6970/-3806, -7177/-3983, -6521/-1769, -1808/-1213, 3649/2047, -6601/-3163, -6084/-324
173	-1570/-149, -2728/-500, -5251/233, -4616/-894, 2039/-1115, -4455/-701, -3328/-1378, 1709/-626, -4212/210, -885/-466, 909/-720, -4101/275, 2203/394, -3835/45, -4013/96, -3541/359, -400/117, 1465/-369, -3192/-294, 427/-249
174	-8077/-149, -7138/-500, -7637/233, -8023/-894, -8516/-1115, -7075/-701, -7642/-1378, -9658/-626, -8487/210, -9057/-466, -8951/-720, -8509/275, -7552/394, -8282/45, -8070/96, -8424/359, -8336/117, -9174/-369, -7395/-294, -8424/-249
175	-8777/-149, -7286/-500, -8125/233, -8503/-894, -8089/-1115, -7246/5476, 5476/-1378, -9783/-626, -8678/210, -9076/-466, -9078/-720, -8509/275, -7683/394, -8576/45, -8145/96, -9272/359, -8931/117, -9493/-369, -7256/-294, -7887/-249
176	-2889/-149, 2001/-500, -4429/233, -3820/-894, -2867/-1115, -4315/-701, -3121/-1378, -831/-626, 117/210, -2749/-466, 3125/-720, -3660/275, -4375/394, -3300/45, 55/96, 996/359, 2538/117, -2318/-369, -3326/-294, -30/-249
177	-82/-149, -10485/-500, -4194/233, -6508/-894, -6579/-1115, 1671/-701, -5822/-1378, -6377/-626, -6284/210, -6626/-466, 96/-720, 230/275, -5088/394, -5833/45, -6089/96, 2399/359, 828/117, -5159/-369, -6797/-294, -6703/-249
178	1475/-149, -4014/-500, -6380/233, -6508/-894, -6579/-1115, 1671/-701, -5822/-1378, -6377/-626, -6284/210, -6626/-466, 96/-720, 230/275, -5088/394, -5833/45, -6089/96, 2399/359, 828/117, -5159/-369, -6797/-294, -6703/-249
179	-2/-149, 1078/-500, 1810/233, -245/-894, -4380/-1115, 493/-701, -2259/-1378, -4123/-626, -1843/210, -4081/-466, -3161/-720, -505/275, 954/394, -1802/45, -643/96, 621/359, 742/117, -1825/-369, 140/-294, 1492/-249
180	-1/-149, 293/-500, 293/233, -1/-894, 1323/-1115, 746/-701, -2252/-1378, -4164/-626, -625/210, -4108/-466, -3181/-720, 366/275, -3686/394, -7/45, -903/96, 74/359, -1029/117, -1325/-369, -4275/-294, -3593/-249
181	-1452/-149, -108/-500, 1337/233, -1713/-894, 450/-1115, 609/-701, 3017/-1378, -4133/-626, -691/210, -2342/-466, -3166/-720, 437/275, -3690/394, 385/45, -2346/96, 1029/359, -91/117, -1321/-369, -4263/-294, 560/-249
182	-82/-149, -10485/-500, -4194/233, -6508/-894, 89/-1115, 685/-701, -2203/412, -907/-626, -923/210, -1650/-466, -3053/-720, -846/275, 1318/394, -1753/45, -1129/96, -287/359, -699/117, -799/-369, 949/-294, -3493/-249
183	-1341/-149, -3956/-500, 208/233, 1481/-894, -1210/-1115, 685/-701, -2203/412, -907/-626, -923/210, -1650/-466, -3882/-720, 356/275, -480/394, -1587/45, -864/96, -328/359, 887/117, -3487/-369, 4543/-294, 1218/-249
184	50/-149, -2754/-500, 884/233, 2171/-894, -3064/-1115, 1269/-701, -892/-412, -2816/-626, -510/210, -2766/-466, -1855/-720, -805/275, -2307/394, -443/45, 864/96, -1150/359, -1225/117, -2372/-369, -2942/-294, 750/-249
185	-475/-8501, -1848/233, 1353/-2588, 1260/233, -2871/-381, -1952/399, -748/106, -2615/-626, -426/210, -2593/-466, 2728/-720, 1416/275, -2136/394, -318/45, -960/96, -1014/359, -1103/117, -2193/-369, -2795/-294, -2097/-249

Row	Data (lower block)
127	-8466/-149; -7310/-500; 4232/233; -7396/-894; -8700/-1115; -7098/-701; -7495/-1378; -9750/-626; -8307/210; -9096/-466; -9042/-720; -7636/275; -7557/394; -7951/45; -8076/96; -8688/359; -8607/117; -9400/-369; -7444/-294; -8581/-249
128	-1/-10485/-11527; 1130/-2705/-5224/-4588; 2004/-410/-3297; 574/-4183; 665/-213; -4072/-4476; -3806/-3983; -1769/-1213; 2047/-3163/-324
129	-1/-10485/-11527; -202/-4206/-7392/-7072; -4907/-7157/-7171; -452/-7025; -944/-3609; -6853/-6944; -6970/-7177; -6521/-1808; 3649/-6601/-6084
130	-1/-10485/-11527; -1570/-2728/-5251/-4616; 2039/-4455/-3328; 1709/-4212; -885/909; -4101/2203; -3835/-4013; -3541/-400; 1465/-3192/427
131	-1/-10485/-11527; -8077/-7138/-7637/-8023; -8516/-7075/-7642; -9658/-8487; -9057/-8951; -8509/-7552; -8282/-8070; -8424/-8336; -9174/-7395/-8424
132	-1/-10485/-11527; -8777/-7286/-8125/-8503; -8089/-7246/5476; -9783/-8678; -9076/-9078; -8509/-7683; -8576/-8145; -9272/-8931; -9493/-7256/-7887
133	-1/-10485/-11527; -2889/2001/-4429/-3820; -2867/-4315/-3121; -831/117; -2749/3125; -3660/-4375; -3300/55; 996/2538; -2318/-3326/-30
134	-82/-10485/-4194; 1475/-4014/-6380/-6508; -6579/1671/-5822; -6377/-6284; -6626/96; 230/-5088; -5833/-6089; 2399/828; -5159/-6797/-6703
135	-2/-10404/-11446; 293/1078/1810/-245; -4380/493/-2259; -4123/-1843; -4081/-3161; -505/954; -1802/-643; 621/742; -1825/140/1492
136	-1/-10485/-11527; 1323/-4092/1113/1711; 450/746/-2252; -4164/-625; -4108/-3181; 366/-3686; -7/-903; 74/-1029; -1325/-4275/-3593
137	-1452/-108/1337; -1713/89/609; 3017/-4133/-691; -2342/-3166; 437/-3690; 385/-2346; 1029/-91; -1321/-4263; 560
138	-82/-10485/-4194; -1341/-3956/208/1481; -1210/685/-2203; -907/-923; -1650/-3882; 356/-480; -1587/-864; -328/887; -3487/949/-3493
139	-167/-10404/-3204; 459/-3868/-497/-1713; -4183/180/-2044; -3930/216; -691/-1650; -3882/356; -480/-1587; -864/-328; 887/-3487/1218
140	-1744/-10239/-513; 50/-2754/884/2171; -3064/1269/-892; -2816/-510; -2766/-1855; -805/-2307; -443/864; -1150/-1225; -2372/-2942/750
141	-475/-8501/-1848; 1353/-2588/1260/1130; -2871/-1952/-748; -2615/-426; -2593/2728; 1416/-2136; -318/-960; -1014/-1103; -2193/-2795/-2097

Table 4, Sheet 10/32

Table (right block):

Idx														
186	-1686 / -231	-2296 / -297	1220 / -372	-803 / 117	-805 / 359	-670 / 97	1549 / 46	-1971 / 391	-564 / 273	-1164 / -723	-2011 / -462	1106 / 210	640 / -629	-555 / 103
195	-2253 / -249	-2606 / -294	-259 / -369	-141 / 117	-417 / 359	-3220 / 96	-2979 / 45	-3816 / 394	-185 / 275	-1354 / -720	-666 / -466	-3285 / 210	-133 / -626	-2613 / 106
196	21 / -249	-3893 / -294	225 / -369	-72 / 117	459 / 359	-91 / 96	2002 / 45	-770 / 394	436 / 275	-2798 / -720	-3723 / -466	973 / 210	93 / -626	-1875 / 106
197	-3291 / -249	-3973 / -294	-688 / -369	-2257 / 117	-219 / 359	1139 / 96	-1492 / 45	1280 / 394	-1928 / 275	-2878 / -720	-3804 / -466	784 / 210	-293 / -626	-1951 / 106
198	885 / -249	-3077 / -294	1238 / -369	622 / 117	1858 / 359	-3529 / 96	-3244 / 45	-4203 / 394	-3562 / 275	-1830 / -720	-2487 / -466	-3505 / 210	180 / -626	-901 / 106
199	1373 / -249	215 / -294	454 / -369	603 / 117	-2853 / 359	959 / 96	-2359 / 45	-3976 / 394	1631 / 275	-2491 / -720	-140 / -466	-1401 / 210	-672 / -626	-299 / 106
200	-3593 / -249	-4275 / -294	-1243 / -369	-898 / 117	1141 / 359	-727 / 96	265 / 45	-297 / 394	-242 / 275	628 / -720	-1722 / -466	1639 / 210	-4164 / -626	-236 / 106
201	-6 / -249	-4099 / -294	-486 / -369	-2387 / 117	1401 / 359	-2170 / 96	-1622 / 45	-711 / 394	1137 / 275	-3004 / -720	-788 / -466	857 / 210	-3982 / -626	-49 / 106
202	763 / -249	-4244 / -294	-3676 / -369	-297 / 117	699 / 359	-1007 / 96	-614 / 45	-639 / 394	924 / 275	-3148 / -720	-1180 / -466	1549 / 210	-1749 / -626	-2384 / 106
203	1094 / -249	-4251 / -294	-3688 / -369	48 / 117	-320 / 359	1407 / 96	-1771 / 45	-3665 / 394	-5 / 275	-3156 / -720	-1755 / -466	447 / 210	-4136 / -626	-2230 / 106
204	-3192 / -249	-3875 / -294	-3314 / -369	231 / 117	975 / 359	-174 / 96	852 / 45	1163 / 394	2037 / 275	-2781 / -720	-1337 / -466	-225 / 210	-3764 / -626	-1851 / 106
205	151 / -249	-3592 / -294	-452 / -369	247 / 117	336 / 359	-841 / 96	979 / 45	1995 / 394	-1876 / 275	-110 / -720	-369 / -466	631 / 210	-3229 / -626	-1859 / 106
206	1996 / -249	-1721 / -294	1038 / -369	-1269 / 117	-1846 / 359	505 / 96	-1890 / 45	-2850 / 394	-2208 / 275	-476 / -720	-1132 / -466	-2150 / 210	727 / -626	-1624 / 106
207	-1766 / -249	-2296 / -294	-6 / -369	70 / 117	-1181 / 359	819 / 96	-605 / 45	-2327 / 394	861 / 275	-1123 / -720	-1901 / -466	-674 / 210	-179 / -626	-940 / 106
208	3252 / -249	1226 / -294	-3334 / -369	63 / 117	135 / 359	-2026 / 96	104 / 45	-3366 / 394	1348 / 275	-2816 / -720	-1250 / -466	877 / 210	-10 / -626	-1657 / 106

Table (lower block):

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142	-863	-2043	-1660	-277	-2257	309	-555
	-149	-502	232	43	-379	399	103
	-3199	-370	-3094	-1784	-495	-825	-1200
143	491	-2153	235	3508	-3609	-3761	-2613
	-149	-500	233	-381	43	399	106
	-9798	-10840	906	-448	-613	-1601	-577
144	-258	-3708	906	-613	-448	-3216	-1875
	-149	-500	233	43	-894	399	106
	-2	-10042	-11084	737	1980	-4108	-251
145	-375	-3789	737	1980	-4108	-251	-2093
	-149	-500	233	43	-894	399	106
	-2	-10133	-11175	527	-3784	-431	-1106
146	480	-2632	527	-3784	-431	222	-1106
	-149	-500	233	43	-894	399	106
	-2	-10298	-11340	-871	-911	814	-135
147	66	-3328	-871	-911	814	289	-135
	-149	-500	233	43	-894	399	106
	-1	-10485	-11527	-1124	486	-4413	-701
148	735	-4092	-1124	486	-4413	652	-701
	-149	-500	233	43	-894	399	106
	-201	-10485	-2953	1012	1114	-706	-1378
149	-456	-3914	1012	1114	-706	-460	-307
	-149	-500	233	43	-894	399	106
	-2	-10286	-11328	257	-1902	-429	-2384
150	606	-4057	257	-1902	-429	1035	-2233
	-149	-500	233	43	-894	399	106
	-2	-10459	-11501	1484	597	-1161	-776
151	-673	-34	1484	597	-1161	1273	-2230
	-149	-500	233	43	-894	399	106
	-446	-10459	-1915	162	-47	-4013	-776
152	199	-3692	162	-47	-4013	-384	-1851
	-149	-500	233	43	-894	399	106
	-105	-10015	-3849	-2140	1114	-3799	-108
153	-2161	-3339	-2140	-79	588	382	-1859
	-149	-500	233	43	-894	399	106
	-1289	-9912	-762	-3028	1286	-4011	-92
154	356	-1278	-3028	1286	1786	-2793	-1624
	-149	-500	233	43	-894	399	106
	-135	-8629	-3521	-781	-47	-5073	-44
155	414	-1974	2293	-781	775	-2242	-940
	-149	-500	233	43	-894	399	106
	-6	-8499	-9542	-466	40	-550	-1657
156	-2293	-3722	-466	40	-4025	-3274	-1934
	-149	-500	233	43	-894	399	106
	-2	-10099	-11141		-894	-225	-2793

Table 4, Sheet 11/32

Each row below is identified by a left label (157–171) and a right label (209–230). Each cell is shown as value / subscript.

#	C1	C2	C3	C4	C5	C6	C7	C8	C9	C10	C11	C12	C13	C14	C15	C16	C17	C18	C19	#
157	71/-149	-4062/-500	527/233	-350/43	-4383/-381	1922/399	-2221/106	-4134/-626	492/210	-3151/-720	-972/275	457/394	-11/45	1582/96	374/359	-343/117	-3684/-369	-4245/-294	-3562/-249	209
158	-2/-360	-10448/-4089	-11490/2756	-894/-254	-1115/-716	-375/-1508	-2128/-2253	-244/-626	546/210	-3178/-720	894/275	-3687/394	1057/45	-2341/96	-152/359	-92/117	-1229/-369	-4273/-294	-3591/-249	210
159	-71/-149	-10485/-500	-4400/233	-894/-4338	-1115/1305	-701/-253	-1378/-623	496/-626	-404/210	-1920/-720	-3930/275	-4423/394	-3647/45	-3866/96	-3446/359	-1205/117	-2136/-369	3651/-294	3644/-249	211
160	-40/-149	-10415/-500	-5247/233	-894/-671	-1115/939	-1890/-3507	-454/288	-4021/-626	-85/210	48/-720	107/275	-940/394	1070/45	-131/96	-716/359	374/117	-1763/-369	392/-294	3076/-249	212
161	-2/-149	-10377/-500	-11419/233	-894/-3797	-1115/960	-2264/-1395	-337/1129	2092/-626	-3527/210	-1911/-720	610/275	-839/394	-716/45	-3570/96	467/359	-877/117	-22/-369	-3157/-294	799/-249	213
162	-2181/-144	-10377/-500	-361/232	-894/44	-1115/-381	-2264/399	-337/105	-2402/-627	1092/210	-1454/-721	-551/275	505/393	-114/48	1041/95	-819/358	-870/117	-1974/-370	-2552/-295	-1882/-250	214
163	-3368/-150	-539/-501	-2219/234	-33/42	-5471/-375	-1006/397	-994/110	-722/-628	-2773/209	-2102/-722	-3944/274	-4583/392	-3265/44	811/102	-3721/358	-3190/124	-2563/-371	5731/-296	-2477/-246	216
164	-397/-149	-2618/-500	-3688/233	-1648/43	-554/-381	-2653/399	-250/106	-3361/-626	932/210	-2437/-720	-1571/275	-720/394	-1136/45	1608/96	-579/359	-1878/117	-2946/-369	-3540/-294	-2876/-249	221
165	-288/-149	-9660/-500	-2475/233	-894/403	-1115/-76	-1807/-2959	-485/1157	-3551/-626	141/210	-2571/-720	-230/275	2752/394	890/45	-1730/96	-1881/359	209/117	-3102/-369	-3663/-294	-2978/-249	222
166	-3/-149	-9688/-500	-10730/233	-894/-293	-1115/-3638	-3554/2536	-128/-1680	736/-626	-200/210	-2471/-720	-1673/275	1374/394	-1239/45	-101/96	-749/359	-197/117	-2961/-369	-3580/-294	-2933/-249	223
167	-606/-149	-9729/-500	-1549/233	-894/-1234	-1115/-82	-4297/-690	-75/-1385	-367/-626	1980/210	-1548/-720	-1474/275	-2771/394	-1054/45	1463/96	326/359	-1519/117	559/-369	2038/-294	396/-249	224
168	-426/-149	-9127/-500	-1978/233	-894/-1044	-1115/-2072	-4838/665	-51/2322	17/-626	295/210	-1144/-720	-1261/275	-2512/394	-848/45	266/96	-18/359	-1228/117	-39/-369	1726/-294	583/-249	225
169	-285/-149	-8707/-500	-2500/233	-894/-585	-1115/-2734	-5043/991	-44/-943	-2438/-626	-611/210	-1644/-721	1424/275	-2322/394	-531/45	-1111/96	1631/359	-1202/117	-44/-369	-2759/-295	1930/-250	226
170	-554/-147	-2243/-501	-3213/234	-87/47	-4100/-377	-5139/-1980	-42/-672	-2514/-627	-280/210	-1575/-721	2156/276	304/393	-223/44	-792/95	578/358	-984/116	-2086/-370	-2670/-295	878/-250	228
171	-1964/-149	-430/-500	-9308/233	-29/579	-5634/-3104	-2593/-2328	-262/1428	708/-626	253/210	-1887/-720	385/275	1812/394	1242/45	-1078/96	-146/359	735/117	-2411/-369	-2985/-294	934/-249	230

Additional sub-rows (where visible):
- 162: -144/-500/232/44/-381/399/105/-627
- 163: -150/-501/234/42/-375/397/110/-628
- 171: -163/-8878/-3259 … -1580/-587

Table 4, Sheet 12/32

Row	c1	c2	c3	c4	c5	c6	c7	c8	c9	c10	c11	c12	c13	c14	c15	c16	c17	c18	c19	c20	Row
172	545 / -149	-3282 / -500	-343 / 233	277 / -894	-3601 / -1115	2235 / 399	-1448 / 106	-342 / -626	-123 / 210	-1030 / -466	-2372 / -720	209 / 275	-2882 / 394	1554 / 45	84 / 96	-1696 / 359	-1754 / 117	-2903 / -369	-3467 / -294	-2785 / -249	231
173	274 / -149	-3822 / -500	826 / 233	-190 / -894	-796 / -1115	1173 / 399	-1982 / 106	-3893 / -626	86 / 210	-3838 / -466	-2911 / -720	2270 / 275	-1235 / 394	-364 / 45	-2070 / 96	-54 / 359	776 / 117	-604 / -369	-4005 / -294	-3323 / -249	232
174	-2513 / -149	1292 / -500	212 / 233	-964 / -894	108 / -1115	58 / 399	-204 / 106	-3970 / -626	-813 / 210	425 / -466	-3029 / -720	68 / 275	1475 / 394	-215 / 45	510 / 96	-1474 / 359	182 / 117	-1248 / -369	-4130 / -294	2118 / -249	233
175	-416 / -149	-4012 / -500	932 / 233	231 / -894	959 / -1115	-3576 / 399	662 / 106	72 / -626	-267 / 210	-909 / -466	-440 / -720	-720 / 275	-3669 / 394	396 / 45	-221 / 96	602 / 359	685 / 117	-1669 / -369	-4209 / -294	1883 / -249	234
176	-1215 / -149	-4092 / -500	757 / 233	-28 / -894	-512 / -1115	-1236 / 399	1865 / 106	-4163 / -626	-668 / 210	-4107 / -466	-3181 / -720	1312 / 275	1610 / 394	717 / 45	-2340 / 96	1339 / 359	-277 / 117	-721 / -369	297 / -294	-3592 / -249	235
177	87 / -149	-451 / -500	1936 / 233	-199 / -894	-4411 / -1115	-955 / 399	-2252 / 106	-1208 / -626	293 / 210	-2357 / -466	-3180 / -720	-74 / 275	2452 / 394	-319 / 45	-161 / 96	-313 / 359	-2558 / 117	-3713 / -369	845 / -294	-3592 / -249	236
178	-145 / -149	1548 / -500	-3360 / 233	-2796 / -894	1809 / -1115	-439 / 399	-2689 / 106	-2692 / -626	-218 / 210	-154 / -466	-2265 / -720	1208 / 275	-1550 / 394	-985 / 45	-2982 / 96	856 / 359	1668 / 117	-2547 / -369	481 / -294	-4 / -249	237
179	-122 / -149	1368 / -500	1509 / 233	-1860 / -894	-4342 / -1115	96 / 399	52 / 106	-265 / -626	-105 / 210	-4039 / -466	-3114 / -720	2707 / 275	94 / 394	-696 / 45	-349 / 96	-2440 / 359	-261 / 117	-3645 / -369	-4209 / -294	-203 / -249	238
180	-2642 / -149	-3153 / -500	-1026 / 233	-1101 / -894	1324 / -1115	-1900 / 399	32 / 106	-1152 / -626	677 / 210	-745 / -466	784 / -720	-410 / 275	-3922 / 394	-2357 / 45	-2825 / 96	-687 / 359	-2582 / 117	-2623 / -369	4896 / -294	1322 / -249	239
181	-2526 / -149	290 / -500	89 / 233	488 / -894	-4278 / -1115	1000 / 399	1233 / 106	922 / -626	665 / 210	-1018 / -466	-3062 / -720	1359 / 275	-3597 / 394	-1708 / 45	776 / 96	-30 / 359	-2465 / 117	-805 / -369	-4160 / -294	232 / -249	240
182	-486 / -149	-3710 / -500	307 / 233	-1543 / -894	1206 / -1115	240 / 399	1404 / 106	-3778 / -626	-220 / 210	-3725 / -466	-2800 / -720	-183 / 275	954 / 394	-233 / 45	-475 / 96	1714 / 359	-951 / 117	-3331 / -369	1938 / -294	-108 / -249	241
183	-1728 / -149	-2015 / -500	-2481 / 233	-1929 / -894	867 / -1115	-374 / 399	3226 / 106	-1618 / -626	374 / 210	-113 / -466	-1203 / -720	1516 / 275	-3040 / 394	-1614 / 45	-2041 / 96	-1971 / 359	-1666 / 117	-1490 / -369	2626 / -294	1901 / -249	242
184	-1792 / -149	2872 / -500	-2132 / 233	-1434 / -894	-2813 / -1115	-2585 / 399	3935 / 106	-2650 / -626	2194 / 210	-2624 / -466	-1910 / -720	-1481 / 275	-2710 / 394	-700 / 45	-125 / 96	-1793 / 359	-1706 / 117	-2378 / -369	-2606 / -294	-2177 / -249	243
185	-1177 / -149	2374 / -500	-3256 / 233	-2703 / -894	3010 / -1115	-2639 / 399	2355 / 106	-451 / -626	-2327 / 210	-789 / -466	-222 / -720	-2183 / 275	-2704 / 394	-1948 / 45	-2179 / 96	-1740 / 359	-1131 / 117	1288 / -369	-914 / -294	-197 / -249	244
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Table 4, Sheet 13/32

247

248

249

250

251

252

253

254

255

256

269

270

271

272

273

187
71 -903 -3098 -2485 -875 30 -1413 2394 -2140 -763 -115 -2097 426 -1816 -2039 -1607 316 695 2758 -1021
-149 -500 233 43 -381 399 106 -626 210 -466 -720 275 394 45 96 359 117 -369 -294 -249

188
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-1031 2075 760 69 17 -3494 1783 -626 210 -466 -720 275 394 45 96 359 117 -369 -294 -249
-149 -500 233 43 -381 399 106

189
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190
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191
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-149 -500 233 43 -381 399 106

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-149 -500 233 43 -381 399 106

193
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947 -4090 1608 -1919 -4410 -1328 -2252 -626 210 -466 -720 275 394 45 96 359 117 -369 -294 -249
-149 -500 233 43 -381 399 106

194
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-2997 -3142 -128 -3498 1171 -1186 -3014 -626 210 -466 -720 275 394 45 96 359 117 -369 -294 -249
-149 -500 233 43 -381 399 106

195
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-149 -500 233 43 -381 399 -1378

196
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-149 -500 231 40 -381 399 105

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-2772 -504 -502 -2375 -2697 1705 -1283 -626 210 -466 -720 275 394 45 96 359 117 -369 -294 -249
-149 -500 233 43 -381 399 106

198
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23 1340 2073 -120 -843 -3569 888 -626 210 -466 -720 275 394 45 96 359 117 -369 -294 -249
-149 -500 233 43 -381 399 106

199
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-461 -290 619 1991 117 681 -2279 -626 210 -466 -720 275 394 45 96 359 117 -369 -294 -249
-149 -500 233 43 -381 399 106

200
-1 -10485 -11527 -894 -1115 -701 -1378 -1256 241 -1157 -458 1822 -3692 787 -979 -1397 537 -1719 1920 -456
-715 -4068 669 1304 678 -3599 297 -626 210 -466 -720 275 394 45 96 359 117 -369 -294 -249
-149 -500 233 43 -381 399 106

201
-1 -10485 -11527 -894 -2524 1545 -2591 -3036 -2404 -2096 -2524 -1211 -915 -494 1309 276 1032 1460 1107 -294
255 -3362 -3081 -2524 -3437 399 106 -626 210 -466 -720 275 394 45 96 359 117 -369 -294 -249
-372 -10485 -2142 -894 -1115 -701 -1378

Table 4, Sheet 14/32

#														
274	-82 / -249	2596 / -294	-3387 / -369	-2242 / 117	-727 / 359	-20 / 96	2171 / 45	-3371 / 394	-799 / 275	-2857 / -720	-1505 / -466	-370 / 210 *	744 / -626 *	-1937 / 106 / -130
275	-3033 / -249	-3716 / -294	-3155 / -369	903 / 117	-427 / 359	-106 / 96	1841 / 45	-3126 / 394	1763 / 275	-2622 / -720	-3549 / -466	-128 / 210 *	-3605 / -626 *	604 / 106
276	3340 / -249	-3095 / -294	-2402 / -369	-1666 / 117	-103 / 359	-1580 / 96	-1027 / 45	-2828 / 394	399 / 275	-1979 / -720	-624 / -466	-1096 / 210 *	-2710 / -626 *	-1422 / 106 / -241
277	3892 / -249	1981 / -294	-2664 / -369	-3264 / 117	-3714 / 359	-4029 / 96	-3667 / 45	-4637 / 394	895 / 275	-2368 / -720	-2869 / -466	-4132 / 210 *	-2723 / -626 *	-2413 / 106 / -198
278	1349 / -249	-2837 / -294	-1983 / -369	807 / 117	-2695 / 359	-3320 / 96	-3050 / 45	-3786 / 394	133 / 275	-1785 / -720	2182 / -466	-3311 / 210 *	-2113 / -626 *	-2737 / 106 / -211
279	545 / -249	1764 / -294	-2684 / -369	142 / 117	-1551 / 359	307 / 96	-852 / 45	-2735 / 394	989 / 275	-2170 / -720	-3080 / -466	-894 / 210 *	-3105 / -626 *	3695 / 106 / -124
280	1525 / -249	-3845 / -294	-1520 / -369	18 / 117	-2285 / 359	-285 / 96	1464 / 45	-758 / 394	-2045 / 275	404 / -720	508 / -466	-280 / 210 *	-3536 / -626 *	-1458 / 106
281	-3493 / -249	-4172 / -294	-1245 / -369	-512 / 117	57 / 359	-60 / 96	-1705 / 45	-3596 / 394	1162 / 275	-3075 / -720	-3997 / -466	-1747 / 210 *	-4043 / -626 *	-2163 / 106 / -1394
282	1529 / -249	1616 / -294	456 / -369	-586 / 117	-103 / 359	-3814 / 96	-1052 / 45	-4392 / 394	-3876 / 275	311 / -720	1539 / -466	-1194 / 210 *	-641 / -626 *	-307 / 106 / -1454
283	933 / -249	387 / -294	1464 / -369	-2632 / 117	-138 / 359	-2823 / 96	-2344 / 45	-659 / 394	-659 / 275	-2439 / -720	-154 / -466	992 / 210 *	-1324 / -626 *	-2591 / 106 / -626
284	-3558 / -249	-4240 / -294	-3679 / -369	-699 / 117	1016 / 359	176 / 96	16 / 45	-3651 / 394	-564 / 275	757 / -720	-4073 / -466	639 / 210 *	-4129 / -626 *	-2216 / 106 / -626
285	423 / -249	-3603 / -294	-2567 / -369	-3287 / 117	-3927 / 359	-4129 / 96	2186 / 45	-4853 / 394	-4298 / 275	2254 / -720	2474 / -466	-4185 / 210 *	-2497 / -626 *	-3651 / 106 / -626
286	-302 / -249	-3492 / -294	-1518 / -369	-2728 / 117	-450 / 359	-1266 / 96	-2744 / 45	3169 / 394	-3124 / 275	-2270 / -720	-1755 / -466	-2878 / 210 *	-922 / -626 *	-2838 / 106 / -1378
287	-5983 / -249	-6886 / -294	-1142 / -369	-4816 / 117	-4424 / 359	-4984 / 96	-3898 / 45	-5270 / 394	256 / 275	-6082 / -720	-6721 / -466	710 / 210 *	-6772 / -626 *	-4206 / 106 / -1378
288	-980 / -249	967 / -294	-654 / -369	-5335 / 117	-6466 / 359	-6445 / 96	-5898 / 45	-6720 / 394	-6796 / 275	-2327 / -720	2782 / -466	-6862 / 210 *	1643 / -626 *	-5463 / 106 / -1378

#						
202	-1167 / -149 / -296	-3767 / -500 / -10115	-1430 / 233 / -2438	-92 / 43 / -894	-4085 / -381 / -1115	1090 / 399 / -3540
203	-923 / -149	-3533 / -500	351 / 233	1521 / 43	-174 / -381	-647 / 399
204	-756 / -149	-9821 / -500	-1297 / 233	-894 / ...	-1115 / -381	-2698 / 399
	-1724 / -149	-2850 / -500	301 / 233	742 / 43	1449 / -381	-339 / 399
205	-4 / ...	-9215 / -10257	-1430 / ...	-894 / ...	-1115 / ...	-2964 / ...
	-468 / -149	1610 / -19	... / 233	-4425 / 43	2001 / -381	-4615 / 399
206	-190 / -149	-9401 / -3038	-3038 / ...	-894 / ...	-1115 / ...	-2877 / ...
	-2272 / -149	-2368 / -3736	-3736 / 233	-3458 / 43	-2327 / -381	1779 / 399
207	-181 / -149	-9392 / -3102	-3102 / ...	-894 / ...	-1115 / ...	-3606 / ...
	-379 / -149	-3074 / 896	896 / 233	-979 / 43	-3371 / -381	379 / 399
208	-3 / ...	-9296 / -10338	-10338 / ...	-894 / ...	-1115 / ...	-653 / ...
	-98 / -149	2770 / 198	198 / 233	-891 / 43	-987 / -381	-15 / 399
209	-2 / ...	-10156 / -11198	-11198 / ...	-894 / ...	-1115 / ...	-691 / ...
	-494 / -149	-3983 / 1162	1162 / 233	689 / 43	2729 / -381	627 / 399
210	-2 / ...	-10369 / -11411	-11411 / ...	-894 / ...	-1115 / ...	-655 / ...
	-190 / -149	-222 / 222	222 / 233	-1870 / 43	962 / -381	-1463 / 399
211	-2 / ...	-10445 / -11487	-11487 / ...	-894 / ...	-1115 / ...	-1507 / ...
	643 / -149	-3274 / 580	580 / 233	-1132 / 43	981 / -381	-423 / 399
212	-2 / ...	-10445 / -11487	-11487 / ...	-894 / ...	-1115 / ...	-1507 / ...
	-19 / -149	-4057 / 510	510 / 233	431 / 43	-699 / -381	1974 / 399
213	-2 / ...	-10445 / -11487	-11487 / ...	-894 / ...	-1115 / ...	-1507 / ...
	-355 / -149	-3235 / -5099	-5099 / 233	-1194 / 43	-2927 / -381	-4831 / 399
214	-2 / ...	-10445 / -11487	-11487 / ...	-894 / ...	-1115 / ...	-359 / ...
	1739 / -149	-3082 / -182	-182 / 233	-3038 / 43	-3102 / -381	-1439 / 399
215	-1 / ...	-10485 / -11527	-11527 / ...	-894 / ...	-1115 / ...	-701 / ...
	-4651 / -149	464 / 3855	3855 / 233	-3094 / 43	-6927 / -381	-4683 / 399
216	-1 / ...	-10485 / -11527	-11527 / ...	-894 / ...	-1115 / ...	-701 / ...
	-5461 / -149	-4986 / -7698	-7698 / 233	-7163 / 43	1022 / -381	-7248 / 399
	-1 / -10485	-500 / -11527		-894	-1115	-701

Table 4, Sheet 15/32

Rows 289–315:

Row	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
289	-3587/-249	797/-294	-3687/-369	-2568/117	-651/359	-517/96	-1810/45	-3699/394	3227/275	-440/-720	-4082/-466	495/210/*	-1255/-626/*	-2266/106/-1378	-1778/399/-701	-4380/-381/-1115	-1938/-894	2159/233/-11527	-4071/-500/-10485	-1455/-149/-1
290	2080/-249	3158/-294	-2176/-369	2462/117	-1878/359	-3946/96	885/45	-955/394	-4017/275	-193/-720	-71/-466	-4087/210/*	-2256/-626/*	-2308/106/-1378	-4433/399/-701	-19/-381/-1115	-4455/-894	-5076/233/-11527	-2760/-500/-10485	-2908/-149/-1
291	-264/-249	-4275/-294	-3714/-369	-536/117	490/359	545/96	723/45	-3686/394	619/275	-3181/-720	-116/-466	-158/210/*	-1840/-626/*	-2251/106/-1378	396/399/-701	-4413/-381/-1115	2089/-894	844/233/-11527	-4092/-500/-10485	-858/-149/-1
292	-3559/-249	-4239/-294	-3680/-369	-2529/117	839/359	-653/96	-1757/45	-3651/394	3577/275	54/-720	-4072/-466	-279/210/*	-4127/-626/*	1588/106/-1378	-3554/399/-701	-4379/-381/-1115	-968/-894	-4122/233/-11527	432/-500/-10485	-2590/-149/-1
293	-3629/-249	880/-294	-3751/-369	1292/117	-300/359	-2379/96	-1826/45	2711/394	971/275	-3220/-720	-4146/-466	-639/210/*	-4201/-626/*	-2284/106/-2731	-235/300/-701	-4450/-381/-1115	874/-894	30/233/-11442	-4130/-500/-10400	-1507/-149/-2
294	1832/-246	-4275/-281	257/-366	188/116	-13/360	-1255/93	771/43	-1618/393	-306/280	-413/-723	-2472/-466	92/209/*	-4163/-625/*	-2252/103/-1378	-513/397/-701	-4412/-383/-1115	1607/-894	726/234/-11527	-4092/-502/-10485	260/-147/-1
304	-3877/-249	-4243/-294	3184/-369	-445/117	-4538/359	-5031/96	-4849/45	-5394/394	-5054/275	-2606/-720	-839/-466	-5173/210/*	230/-626/*	-4429/106/-1511	-5405/399/-701	-262/-383/-1115	-2588/-894	-3805/234/-11492	-3650/-500/-10450	-236/-147/-1
305	1201/-249	-3297/-294	1420/-369	-2751/117	-714/359	2202/96	2287/45	-4274/394	-3487/275	460/-720	-2725/-466	-1463/210/*	614/-626/*	-3013/106/-1378	-4213/399/-701	-2846/-381/-1115	-3574/-894	-6066/233/-11527	1317/-500/-10378	-44/-149/-1
306	-3593/-249	-4276/-294	-3715/-369	-1255/117	210/359	695/96	1796/45	-3686/394	1775/275	-3182/-720	-4109/-466	1025/210/*	-992/-626/*	-2252/106/-2097	-125/399/-384	-4414/-381/-1115	319/-894	1469/233/-11492	-4093/-500/-10450	65/-149/-2
307	1757/-249	-4275/-294	-587/-369	-519/117	-2500/359	408/96	679/45	-3686/394	354/275	113/-720	-1668/-466	366/210/*	-4162/-626/*	1269/106/-1378	-1356/399/-701	-4412/-381/-1115	2053/-894	-1137/233/-11527	-4091/-500/-10485	-651/-149/-1
308	1633/-249	417/-294	517/-369	-1544/117	-3507/359	-3976/96	-626/45	-4473/394	-273/275	2195/-720	939/-466	-1151/210/*	2094/-626/*	-3293/106/-1378	-4423/399/-701	971/-381/-1115	-4573/-894	-1848/233/-11527	-2706/-500/-10485	338/-149/-1
309	2186/-249	-3509/-294	149/-369	-463/117	-679/359	-237/96	-1024/45	-1626/394	-1261/275	245/-720	680/-466	1468/210/*	-228/-626/*	-2787/106/-1378	-4035/399/-701	-496/-381/-1115	-1085/-894	-3504/233/-11527	-3111/-500/-10485	-1252/-149/-1
310	-357/-249	-4275/-294	-3713/-369	88/117	-1480/359	309/96	-1792/45	-3686/394	1611/275	-3180/-720	-996/-466	1126/210/*	-1262/-626/*	-2252/106/-1378	-1776/399/-701	-4411/-381/-1115	907/-894	2196/233/-11527	-4091/-500/-10485	806/-149/-1
311	2148/-250	4062/-295	-2858/-370	-325/116	670/360	-1991/95	-1457/44	-3276/393	-1883/275	-2425/-721	-3265/-467	-1511/212/*	-3174/-627/*	-1863/111/-4734	-864/398/-55	473/-381/-1115	1169/-894	320/234/-10929	-3300/-501/-10485	130/-147/-1
315	-2821/-249	-3163/-294	1575/-369	-956/117	-319/359	-3981/96	-3803/45	-4475/394	-4070/275	2050/-720	1109/-466	-4179/210/*	1273/-626/*	-3297/106/-1378	-146/399/-1115	-497/-381/-1115	-1393/-894	-5219/233/-11527	-2705/-500/-10485	880/-149/-1

Rows 217–231:

Row	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
217	-1455/-149/-1	-4071/-500/-10485	2159/233/-11527	-1938/-894	-4380/-381/-1115	-1778/399/-701	-2266/106/-1378	-1255/-626/*	495/210/*	-4082/-466	-440/-720	3227/275	-3699/394	-1810/45	-517/96	-651/359	-2568/117	-3687/-369	797/-294	-3587/-249
218	-2908/-149/-1	-2760/-500/-10485	-5076/233/-11527	-4455/-894	-19/-381/-1115	-4433/399/-701	-2308/106/-1378	-2256/-626/*	-4087/210/*	-71/-466	-193/-720	-4017/275	-955/394	885/45	-3946/96	-1878/359	2462/117	-2176/-369	3158/-294	2080/-249
219	-858/-149/-1	-4092/-500/-10485	844/233/-11527	2089/-894	-4413/-381/-1115	396/399/-701	-2251/106/-1378	-1840/-626/*	-158/210/*	-116/-466	-3181/-720	619/275	-3686/394	723/45	545/96	490/359	-536/117	-3714/-369	-4275/-294	-264/-249
220	-2590/-149/-1	432/-500/-10485	-4122/233/-11527	-968/-894	-4379/-381/-1115	-3554/399/-701	1588/106/-1378	-4127/-626/*	-279/210/*	-4072/-466	54/-720	3577/275	-3651/394	-1757/45	-653/96	839/359	-2529/117	-3680/-369	-4239/-294	-3559/-249
221	-1507/-149/-2	-4130/-500/-10400	30/233/-11442	874/-894	-4450/-381/-1115	-235/300/-701	-2284/106/-2731	-4201/-626/*	-639/210/*	-4146/-466	-3220/-720	971/275	2711/394	-1826/45	-2379/96	-300/359	1292/117	-3751/-369	880/-294	-3629/-249
222	260/-147/-1	-4092/-502/-10485	726/234/-11527	1607/-894	-4412/-383/-1115	-513/397/-701	-2252/103/-1378	-4163/-625/*	92/209/*	-2472/-466	-413/-723	-306/280	-1618/393	771/43	-1255/93	-13/360	188/116	257/-366	-4275/-281	1832/-246
223	-236/-147/-1	-3650/-500/-10450	-3805/234/-11492	-2588/-894	-262/-383/-1115	-5405/399/-701	-4429/106/-1511	230/-626/*	-5173/210/*	-839/-466	-2606/-720	-5054/275	-5394/394	-4849/45	-5031/96	-4538/359	-445/117	3184/-369	-4243/-294	-3877/-249
224	-44/-149/-1	1317/-500/-10378	-6066/233/-11527	-3574/-894	-2846/-381/-1115	-4213/399/-701	-3013/106/-1378	614/-626/*	-1463/210/*	-2725/-466	460/-720	-3487/275	-4274/394	2287/45	2202/96	-714/359	-2751/117	1420/-369	-3297/-294	1201/-249
225	65/-149/-2	-4093/-500/-10450	1469/233/-11492	319/-894	-4414/-381/-1115	-125/399/-384	-2252/106/-2097	-992/-626/*	1025/210/*	-4109/-466	-3182/-720	1775/275	-3686/394	1796/45	695/96	210/359	-1255/117	-3715/-369	-4276/-294	-3593/-249
226	-651/-149/-1	-4091/-500/-10485	-1137/233/-11527	2053/-894	-4412/-381/-1115	-1356/399/-701	1269/106/-1378	-4162/-626/*	366/210/*	-1668/-466	113/-720	354/275	-3686/394	679/45	408/96	-2500/359	-519/117	-587/-369	-4275/-294	1757/-249
227	338/-149/-1	-2706/-500/-10485	-1848/233/-11527	-4573/-894	971/-381/-1115	-4423/399/-701	-3293/106/-1378	2094/-626/*	-1151/210/*	939/-466	2195/-720	-273/275	-4473/394	-626/45	-3976/96	-3507/359	-1544/117	517/-369	417/-294	1633/-249
228	-1252/-149/-1	-3111/-500/-10485	-3504/233/-11527	-1085/-894	-496/-381/-1115	-4035/399/-701	-2787/106/-1378	-228/-626/*	1468/210/*	680/-466	245/-720	-1261/275	-1626/394	-1024/45	-237/96	-679/359	-463/117	149/-369	-3509/-294	2186/-249
229	806/-149/-1	-4091/-500/-10485	2196/233/-11527	907/-894	-4411/-381/-1115	-1776/399/-701	-2252/106/-1378	-1262/-626/*	1126/210/*	-996/-466	-3180/-720	1611/275	-3686/394	-1792/45	309/96	-1480/359	88/117	-3713/-369	-4275/-294	-357/-249
230	130/-147/-1	-3300/-501/-10485	320/234/-10929	1169/-894	473/-381/-1115	-864/398/-55	-1863/111/-4734	-3174/-627/*	-1511/212/*	-3265/-467	-2425/-721	-1883/275	-3276/393	-1457/44	-1991/95	670/360	-325/116	-2858/-370	4062/-295	2148/-250
231	880/-149/-1	-2705/-500/-10485	-5219/233/-11527	-1393/-894	-497/-381/-1115	-146/399/-1115	-3297/106/-1378	1273/-626/*	-4179/210/*	1109/-466	2050/-720	-4070/275	-4475/394	-3803/45	-3981/96	-319/359	-956/117	1575/-369	-3163/-294	-2821/-249

Table 4, Sheet 16/32

Table 4, Sheet 17/32 — data matrix. Each row carries a left-margin index (232–246) and a right-margin index (316–341). Each column entry is shown as a stack of values (upper value, middle value, and — for the seven left-hand columns — a lower value). The ninth column of each row is marked with an asterisk (*).

Row 232 / 316
- Upper: 727, -57, -1515, -3685, -2832, -68, -3067, 1080, 799, 359, 1459, 1063, -4314, -3227, -1673, -82, -1530, 871, -3293, -301
- Middle: -149, -500, 233, 43, -381, 399, 106, -626, 210, -466, -720, 275, 394, 45, 96, 359, 117, -369, -294, -249
- Lower (cols 1–7): -25, -10485, -5900, -894, -1115, -701, -1378

Row 233 / 317
- Upper: -345, -4072, 1466, -4393, -3012, -131, 1146, -4144, 1820, -4088, -3161, 77, -3665, 415, 805, -1371, -33, -3694, 3083, -3572
- Middle: -150, -501, 234, 42, -382, 399, 104, -628, 209, -465, -722, 274, 395, 44, 97, 358, 121, -371, -296, -240
- Lower (cols 1–7): -40, -5208, -11503, -382, -191, -446, -1911

Row 234 / 327
- Upper: -3098, 557, 5412, -4796, 2467, -4633, 1098, -2384, -4390, 1748, 408, -4253, -4674, -3991, -113, -3721, -3037, -908, -3157, 2811
- Middle: -149, -500, 233, 43, -381, 399, 106, -626, 210, -466, -720, 275, 394, 45, 96, 359, 117, -369, -294, -249
- Lower (cols 1–7): -1, -10485, -11527, -894, -1115, -701, -1378

Row 235 / 328
- Upper: -440, -2770, -4991, -4354, -2731, -4413, -3255, 134, 119, -429, -1971, -3962, -4464, -1018, 73, -3489, -1348, 621, 5347, -2874
- Middle: -149, -500, 233, 43, -381, 399, 106, -626, 210, -466, -720, 275, 394, 45, 96, 359, 117, -369, -294, -249
- Lower (cols 1–7): -1, -10485, -11527, -894, -1115, -701, -1378

Row 236 / 329
- Upper: 518, -2762, -8, -4162, -1014, -233, -3201, 1185, -3847, 1655, 858, 446, -4409, -1240, -1731, 15, -797, -383, -3212, -256
- Middle: -149, -500, 233, 43, -381, 399, 106, -626, 210, -466, -720, 275, 394, 45, 96, 359, 117, -369, -294, -249
- Lower (cols 1–7): -352, -10485, -11527, -894, -1115, -701, -1378

Row 237 / 330
- Upper: -2321, -3792, 2018, 1012, -4112, 4, -1953, -3862, 532, -740, 381, 1728, -3388, -1494, 1351, -730, -2260, -3414, 841, -3293
- Middle: -149, -500, 233, 43, -381, 399, 106, -626, 210, -466, -720, 275, 394, 45, 96, 359, 117, -369, -294, -249
- Lower (cols 1–7): -92, -10135, -4037, -894, -1115, -701, -775

Row 238 / 331
- Upper: -250, -3844, 749, 681, -4165, -1267, 1082, -3915, 1250, -2157, 458, -1981, -495, 607, 655, -2252, 491, -3466, 1014, 1304
- Middle: -149, -500, 233, 43, -381, 399, 106, -626, 210, -466, -720, 275, 394, 45, 96, 359, 117, -369, -294, -249
- Lower (cols 1–7): -500, -10197, -2213, -894, -1115, -701, -158

Row 239 / 332
- Upper: -2222, -2815, -28, -2116, 41, 3002, -2197, -2568, -2074, -2812, -2078, -563, -315, -1959, -2465, 200, -2200, -465, 1650, -2767
- Middle: -149, -500, 233, 43, -381, 399, 106, -626, 210, -466, -720, 275, 394, 45, 96, 359, 117, -369, -294, -249
- Lower (cols 1–7): -2227, -9699, -349, -894, -1115, -701, -73

Row 240 / 333
- Upper: -690, -1030, -349, 667, -1112, 1526, -775, -536, -770, -926, 2421, -983, -2034, -651, -1069, -950, -658, 1348, -1510, -1082
- Middle: -149, -500, 234, 45, -381, 398, 105, -627, 211, -465, -721, 276, 393, 48, 98, 359, 117, -370, -295, -250
- Lower (cols 1–7): -2648, -650, -1347, -894, -1115, -701, -115

Row 241 / 336
- Upper: -1684, -3381, 2298, 2247, -3628, -3702, -1105, -3463, -1067, -3374, -2571, 1229, -2376, -724, -1746, -1436, 1284, -2978, -3559, -2700
- Middle: -149, -500, 233, 43, -381, 399, 106, -626, 210, -466, -720, 275, 394, 45, 96, 359, 117, -369, -294, -249
- Lower (cols 1–7): -265, -7722, -2300, -894, -1115, -701, -547

Row 242 / 337
- Upper: -498, -1527, -664, -3408, 1644, -1665, -2119, 1205, -3003, 1436, 1589, -2893, -3297, -2626, -2804, -2332, -1641, 927, 2073, 992
- Middle: -149, -500, 233, 43, -381, 399, 106, -626, 210, -466, -720, 275, 394, 45, 96, 359, 117, -369, -294, -249
- Lower (cols 1–7): -4, -9095, -2618, -894, -1115, -701, -106

Row 243 / 338
- Upper: -241, -4561, 1267, -1550, -5048, -3824, -2504, -4899, -2536, -4814, -4030, 545, -3695, 1178, -3239, -874, -3044, -4358, -5001, -4130
- Middle: -149, -500, 233, 43, -381, 399, 106, -626, 210, -466, -720, 275, 394, 45, 96, 359, 117, -369, -294, -249
- Lower (cols 1–7): -4, -9182, -10137, -894, -1115, -701, -4060

Row 244 / 339
- Upper: 707, 529, -5359, -4732, 472, -89, 76, 2402, -4335, -790, 262, -4224, -4619, -3963, -4141, -3668, -2943, 2418, -3322, -2979
- Middle: -149, -500, 233, 43, -381, 399, 106, -626, 210, -466, -720, 275, 394, 45, 96, 359, 117, -369, -294, -249
- Lower (cols 1–7): -36, -10450, -10224, -894, -1115, -4060, -675

Row 245 / 340
- Upper: 108, -5784, 3750, -2898, -6561, -553, -3961, -6451, -304, -6372, -5641, -3250, -5036, -3629, -4889, -171, -4466, -5826, -6560, -844
- Middle: -149, -500, 233, 43, -381, 399, 106, -626, 210, -466, -720, 275, 394, 45, 96, 359, 117, -369, -294, -249
- Lower (cols 1–7): -2, -10415, -11458, -894, -1115, -267, -2564

Row 246 / 341
- Upper: -882, -4791, -7040, -7394, -6930, 3753, -6508, -7307, -7247, -7441, -6597, -5861, -5815, -6771, -6872, -4523, -4737, -6054, 933, -6891
- Middle: -149, -500, 233, 43, -381, 399, 106, -626, 210, -466, -720, 275, 394, 45, 96, 359, 117, -369, -294, -249
- Lower (cols 1–7): -1, -10485, -11527, -894, -1115, -701, -1378

Table 4, Sheet 17/32

Table 4, Sheet 18/32. Each cell is given as *top value / bottom value*; the left-hand index (247–261) and the right-hand index (342–384) identify the row. The bottom (y) values form a near-constant template across the rows: [-149, -500, 233, -894, -381, 399, 106, -626, 210, -466, -720, 275, 394, 45, 96, 359, 117, -369, -294, -249] (rows 257 and 258 differ slightly). Several left-hand columns also carry a third (lower) value; for rows 247–256 these are C1 = -1, C2 = -11527, C5 = -1115, C6 = -701, C7 = -1378. Asterisks (*) appear in the printed table next to the C7/C8 columns for the lower rows.

idx(L)	C1	C2	C3	C4	C5	C6	C7	C8	C9	C10	C11	C12	C13	C14	C15	C16	C17	C18	C19	C20	idx(R)
247	-6543/-149	-5722/-500	-7433/233	-7597/-894	3802/-381	-7222/399	-3668/106	494/-626	-7173/210	255/-466	-4495/-720	-5988/275	-7055/394	-748/45	-6609/96	-6447/359	-6415/117	-5422/-369	3771/-294	92/-249	342
248	-6705/-149	-6597/-500	-7597/233	-6711/-894	-7409/-381	-6618/399	-5618/106	-7674/-626	-4419/210	-7152/-466	33/-720	-6439/275	-6902/394	-5393/45	4226/96	-6812/359	-6659/117	-7468/-369	-6649/-294	-6845/-249	343
249	-5076/-149	-4650/-500	-7488/233	-6907/-894	1609/-381	-6991/399	-5853/106	2609/-626	-1344/210	1676/-466	2141/-720	-6665/275	-6557/394	-5839/45	-6306/96	-6199/359	-4979/117	445/-369	-4988/-294	-4973/-249	344
250	-7293/-149	-7123/-500	4192/233	-5905/-894	-7868/-381	-6589/399	-6618/106	-8745/-626	-7289/210	-1940/-466	-8114/-720	-6217/275	-7106/394	-6709/45	-7576/96	-7234/359	-7475/117	-8427/-369	-7251/-294	-7548/-249	345
251	2483/-149	-2715/-500	-5223/233	-4589/-894	961/-381	-4433/399	154/106	-752/-626	-4186/210	-1198/-466	-1919/-720	-4078/275	-4484/394	-3812/45	-3990/96	-1105/359	1109/117	1651/-369	-3176/-294	-2833/-249	346
252	2379/-149	-2938/-500	-5404/233	-2004/-894	-2980/-381	-1281/399	-3615/106	714/-626	-4438/210	-2819/-466	193/-720	-4299/275	-4697/394	-4079/45	-4268/96	-903/359	-3050/117	2448/-369	-3509/-294	-3164/-249	347
253	-2633/-149	-4104/-500	-1140/233	-1930/-894	-4426/-381	-1114/399	195/106	-4175/-626	3070/210	-2035/-466	-3193/-720	1385/275	362/394	-1802/45	351/96	-251/359	-866/117	-3726/-369	-4286/-294	-3605/-249	348
254	-2885/-149	-2752/-500	-4977/233	201/-894	73/-381	530/399	4521/106	-2250/-626	-4009/210	-482/-466	1252/-720	-3962/275	-4455/394	-3677/45	-3896/96	-1731/359	-2826/117	-727/-369	-3185/-294	141/-249	349
255	-2968/-149	-2788/-500	-5317/233	-4683/-894	-582/-381	-1479/399	-3399/106	2480/-626	-4281/210	4/-466	2830/-720	-4171/275	-988/394	-3900/45	-4081/96	-3612/359	-2908/117	1493/-369	-3254/-294	1837/-249	350
256	502/-149	-4092/-500	1261/233	-53/-894	263/-381	-72/399	-2252/106	-4163/-626	-166/210	-4108/-466	-3181/-720	-601/275	1215/394	-609/45	-740/96	1631/359	-2558/117	-3714/-369	1322/-294	641/-249	351
257	411/-150	-4077/-501	-106/236	1023/-379	584/-379	-3597/398	1678/108	-1191/-623	1718/209	-390/-468	8/-722	262/274	1013/396	-704/44	-2346/96	-1133/360	-1329/116	-3696/-366	-4265/-296	-940/-251	352
258	-5649/-411	-1702/-506	-572/264	748/-375	-6554/-3114	-2333/397	-996/100	-2857/-637	-582/194	-2816/-479	-1898/-736	-973/283	1512/414	1354/28	242/89	-1244/355	-1299/113	-445/-372	-2995/-288	-2319/-222	354
259	-1416/-149	-2774/-500	1429/43	-736/-894	-3035/-381	-2386/399	1075/106	242/-626	-666/210	-2768/-466	-1878/-720	2745/275	-111/394	-622/45	569/96	-1317/359	-1357/117	-2372/-369	-2977/-294	1327/-249	382
260	513/-149	1170/-500	-192/43	-1660/-894	-2115/-381	2157/399	-1598/106	778/-626	-1527/210	-1967/-466	-1252/-720	1387/275	-2915/394	-1416/45	-1874/96	-1807/359	-99/117	-1536/-369	-2462/-294	897/-249	383
261	557/-149	-4061/-500	-56/233	474/-894	-4382/-381	1288/399	-175/106	-4132/-626	-1802/210	-2004/-466	-3150/-720	-494/275	1458/394	382/45	-564/96	756/359	-301/117	-3683/-369	796/-294	988/-249	384

Table 4 (Sheet 19/32). Each row is labelled on the left (262–276) and on the right (385–410). Within each row the values are given as stacked groups (left-most eight groups have three values, the remainder have two values).

Row (L)	Row (R)	Data groups (left → right)
262	385	(-1153, -149, -1) (-2879, -500, -10485) (1150, 233, -11527) (-3594, 43, -894) (2837, -381, -1115) (-1439, 399, -701) (-292, 106, -1378) (319, -626, *) (-1519, 210) (-1069, -466) (-439, -720) (-1257, 275) (-4293, 394) (-3162, 45) (1061, 96) (-768, 359) (-1281, 117) (-807, -369) (2822, -294) (-274, -249)
263	386	(122, -149, -1) (-2720, -500, -10485) (-1621, 233, -11527) (-4453, 43, -894) (-1028, -381, -1115) (-539, 399, -701) (-3269, 106, -1378) (1036, -626, *) (-4078, 210) (1050, -466) (-1922, -720) (-802, 275) (-4456, 394) (1084, 45) (-3927, 96) (-838, 359) (-1339, 117) (403, -369) (3926, -294) (595, -249)
264	387	(-233, -149, -1) (-4093, -500, -10485) (-707, 233, -11527) (-1918, 43, -894) (-4414, -381, -1115) (-3594, 399, -701) (2926, 106, -1378) (-4165, -626, *) (1899, 210) (-4109, -466) (-3182, -720) (-744, 275) (114, 394) (1144, 45) (1484, 96) (-362, 359) (548, 117) (-1876, -369) (-4276, -294) (-3593, -249)
265	388	(499, -149, -1) (-4092, -500, -10485) (580, 233, -11527) (1661, 43, -894) (-4413, -381, -1115) (-1745, 399, -701) (436, 106, -1378) (708, -626, *) (417, 210) (-4108, -466) (-3181, -720) (205, 275) (-1007, 394) (934, 45) (-2339, 96) (753, 359) (-672, 117) (-258, -369) (-4275, -294) (-3593, -249)
266	389	(-2891, -149, -1) (-2717, -500, -10485) (-5233, 233, -11527) (-4599, 43, -894) (3037, -381, -1115) (-4438, 399, -701) (-3300, 106, -1378) (752, -626, *) (-4194, 210) (142, -466) (283, -720) (-889, 275) (-4487, 394) (-1135, 45) (-3994, 96) (-1378, 359) (-2832, 117) (-1132, -369) (3346, -294) (2415, -249)
267	390	(-503, -149, -1) (-3183, -500, -10485) (-1037, 233, -11527) (-1492, 43, -894) (-3218, -381, -1115) (-3985, 399, -701) (813, 106, -1378) (306, -626, *) (55, 210) (370, -466) (2307, -720) (-1113, 275) (-1033, 394) (-2549, 45) (1152, 96) (-2960, 359) (1259, 117) (340, -369) (884, -294) (892, -249)
268	391	(-159, -149, -1) (-4092, -500, -10485) (1289, 233, -11527) (912, 43, -894) (-4413, -381, -1115) (-955, 399, -701) (1047, 106, -1378) (-4164, -626, *) (313, 210) (-4108, -466) (-431, -720) (-380, 275) (-45, 394) (1806, 45) (-1132, 96) (850, 359) (246, 117) (-1172, -369) (-4276, -294) (-386, -249)
269	392	(1274, -149, -1) (-4093, -500, -10485) (1238, 233, -11527) (1709, 43, -894) (-4414, -381, -1115) (-1956, 399, -701) (1673, 106, -1378) (-4165, -626, *) (1186, 210) (-4109, -466) (-3182, -720) (745, 275) (-3686, 394) (-736, 45) (397, 96) (-1517, 359) (-2558, 117) (-1728, -369) (-4276, -294) (-674, -249)
270	393	(407, -149, -1) (-2709, -500, -10485) (-5213, 233, -11527) (-4578, 43, -894) (-2664, -381, -1115) (-4428, 399, -701) (-3299, 106, -1378) (1337, -626, *) (-4176, 210) (982, -466) (2698, -720) (-4069, 275) (-20, 394) (294, 45) (-3981, 96) (-61, 359) (-775, 117) (1488, -369) (-3168, -294) (-2826, -249)
271	394	(85, -149, -1) (-4092, -500, -10485) (262, 233, -11527) (-1918, 43, -894) (-4414, -381, -1115) (199, 399, -701) (975, 106, -1378) (-4164, -626, *) (1815, 210) (-4108, -466) (-3182, -720) (2049, 275) (361, 394) (-319, 45) (167, 96) (-1030, 359) (-407, 117) (-3714, -369) (-4276, -294) (1098, -249)
272	395	(1241, -149, -144) (-3970, -500, -10485) (-3406, 462, -11527) (1296, 43, -894) (-4291, -381, -1115) (-189, 399, -701) (-2129, 106, -1378) (-4042, -626, *) (-267, 210) (-3986, -466) (-3059, -720) (1664, 275) (178, 394) (821, 45) (69, 96) (334, 359) (-577, 117) (-3592, -369) (-4153, -294) (-3470, -249)
273	396	(625, -149, -1) (-2676, -500, -10485) (-1177, 233, -11527) (670, 43, -894) (-171, -381, -1115) (85, 399, -701) (-80, 106, -1378) (494, -626, *) (232, 210) (-329, -466) (-1859, -720) (-2778, 275) (-3779, 394) (-2399, 45) (-2817, 96) (-2704, 359) (1049, 117) (628, -369) (-3084, -294) (2108, -249)
274	397	(73, -149, -226) (-2503, -500, -10060) (-1066, 233, -2793) (-2471, 43, -894) (-21, -381, -1115) (-692, 399, -701) (-116, 538, -1378) (-115, -626, *) (1235, 210) (-326, -466) (890, -720) (829, 275) (-3575, 394) (-2174, 45) (-2598, 96) (443, 359) (794, 117) (938, -369) (-2908, -294) (-180, -249)
275	398	(-80, -143, -717) (-2978, -506, -9836) (1132, 231, -1356) (1325, 44, -894) (1194, -380, -1115) (-2498, 395, -4142) (-1158, 104, -84) (-3038, -628, *) (794, 221) (122, -467) (-2069, -713) (-1136, 277) (-50, 393) (-700, 41) (870, 93) (-265, 356) (-98, 114) (-2597, -368) (-3166, -264) (-2487, -255)
276	410	(-1944, -356, -1944) (-2494, -436, -10060) (1117, 233, -10165) (-1835, -163, -1835) (-2635, -475, -2635) (1340, 399, -4841) (-1339, 106, -51) (-366, -626, *) (-1043, 210) (-2432, -466) (785, -720) (-1402, 275) (-2734, 394) (-980, 45) (-1496, 96) (1458, 359) (735, 117) (305, -369) (-2800, -294) (-2250, -249)

(Additional bottom row: (-4, -9123, -10165) (-356, -500, 233) (-149, -10165) … -2882 / -1115 / -210)

Table 4, Sheet 19/32

Left block (rows 277–291) — each labeled entry shows three stacked values per column (top / middle / bottom):

Row	C1	C2	C3	C4	C5	C6	C7
277	-1905 / -149 / -3	-3358 / -500 / -9346	-239 / 233 / -10389	-1142 / -894 /	-3665 / -381 /	1869 / 399 / -972	1510 / 106 / -1028
278	-1093 / -149 / -2	-3703 / -500 / -10028	369 / 233 / -11070	430 / 43 /	-4024 / -381 /	-1118 / 399 / -950	890 / 106 / -1052
279	-976 / -149 / -2	-3912 / -500 / -10276	1701 / 233 / -11318	1575 / 43 /	-1111 / -381 / -124	505 / 399 /	-2074 / 106 / -3599
280	429 / -149 / -2	71 / -500 / -10485	-1863 / 233 / -11527	-1322 / -894 /	834 / -381 / -1115	-1166 / 399 /	-3269 / 106 /
281	-781 / -149 / -1	-2711 / -500 / -10485	-348 / 233 / -11527	-907 / -894 /	3229 / -381 /	-4417 / 399 / -701	-3270 / 106 / -1378
282	-561 / -149 / -31	1323 / -500 / -10485	-5196 / 233 / -11498	-4560 / 43 /	109 / -381 /	-4398 / 399 / -412	-3390 / 106 / -2008
283	-2959 / -149 / -2	-2779 / -500 / -10455	-5308 / 233 / -11498	-4674 / 43 /	2352 / -381 /	-4516 / 399 / -701	-4075 / 106 / -1378
284	968 / -149 / -1	-6618 / -500 / -10485	158 / 233 / -11527	-1335 / 43 /	-6920 / -381 /	3180 / 399 / -701	-5139 / 106 / -1378
285	-5864 / -149 / -1	-7026 / -500 / -10485	-3549 / 233 / -11527	3932 / 43 /	-7732 / -381 /	-5502 / 399 / -701	-5139 / 106 / -1378
286	-242 / -149 / -1	-2704 / -500 / -10485	-5221 / 233 / -11527	-4585 / 43 /	-167 / -381 /	-4425 / 399 / -701	-4425 / 106 / -1378
287	-1781 / -149 / -1	-2711 / -500 / -10485	-1661 / 233 / -11527	-4530 / 43 /	1589 / -381 /	-1110 / 399 / -701	-349 / 106 / -1378
288	162 / -149 / -2847	-4088 / -500 / -10485	1418 / 233 / -217	-714 / 43 /	-4408 / -381 /	1367 / 399 / -701	2467 / 106 / -1378
289	-732 / -148 / -518	-1200 / -503 / -1741	-2291 / 235 / -8690	-1892 / 42 / -3476	-2006 / -383 / -136	1184 / 402 / -327	-1642 / 103 / -2302
290	588 / -149 / -86	-3859 / -500 / -10220	1096 / 233 / -4136	-225 / 43 / -894	-4178 / -381 / -1115	1819 / 399 / -3177	-2025 / 106 / -169
291	1059 / -149 / -2561	-3794 / -500 / -10136	1830 / 233 / -269	-152 / 43 / -894	-4111 / -381 / -1115	1065 / 399 / -3476	-1969 / 106 / -136

Right block (rows 411–437) — each column cell shows two stacked values (top / bottom):

Row	C1	C2	C3	C4	C5	C6	C7	C8	C9	C10	C11	C12	C13
411	2375 / -249	-3528 / -294	-2980 / -369	-1846 / 117	-1780 / 359	1325 / 96	1163 / 45	597 / 394	-1452 / 275	-2456 / -720	-3364 / -466	-1072 / 210*	-3416 / -626*
412	896 / -249	-3886 / -294	-3325 / -369	-2169 / 117	691 / 359	570 / 96	426 / 45	1981 / 394	-1839 / 275	-2792 / -720	-3719 / -466	1641 / 210*	-3775 / -626*
413	-3413 / -249	2039 / -294	-1765 / -369	-2380 / 117	50 / 359	-2163 / 96	-1615 / 45	1566 / 394	430 / 275	-3001 / -720	-3927 / -466	326 / 210*	-3981 / -626*
414	-2830 / -249	-3175 / -294	1285 / -369	215 / 117	-364 / 359	692 / 96	-3728 / 45	129 / 394	-4006 / 275	1507 / -720	448 / -466	-4079 / 210*	893 / -626*
415	2512 / -249	990 / -294	-1046 / -369	-2816 / 117	-3498 / 359	-3958 / 96	-3771 / 45	-774 / 394	-4042 / 275	2103 / -720	-1108 / -466	-4136 / 210*	-1048 / -626*
416	-208 / -249	1341 / -294	1040 / -369	1924 / 117	-1828 / 359	-3955 / 96	-643 / 45	-4448 / 394	-1446 / 275	1757 / -720	304 / -466	-4155 / 210*	1605 / -626*
417	1386 / -249	-3246 / -294	2596 / -369	-218 / 117	-3602 / 359	-4072 / 96	-3892 / 45	-4560 / 394	-4162 / 275	207 / -720	239 / -466	-1723 / 210*	290 / -626*
418	-5886 / -249	-6934 / -294	-6301 / -369	-4868 / 117	-4432 / 359	-5293 / 96	1419 / 45	-5218 / 394	-3269 / 275	-6095 / -720	-2189 / -466	-4391 / 210*	-6860 / -626*
419	-6874 / -249	-7315 / -294	-7450 / -369	-6009 / 117	-5553 / 359	-6414 / 96	-4906 / 45	-6088 / 394	-1213 / 275	-7325 / -720	-7778 / -466	-5596 / 210*	-8036 / -626*
420	1326 / -249	2926 / -294	2210 / -369	-1307 / 117	-3509 / 359	-3981 / 96	-3804 / 45	-862 / 394	-1502 / 275	1375 / -720	-274 / -466	-1866 / 210*	1435 / -626*
421	1422 / -249	4640 / -294	-795 / -369	-2816 / 117	-532 / 359	-750 / 96	-3772 / 45	-1510 / 394	-4043 / 275	-1913 / -720	-298 / -466	-4138 / 210*	1399 / -626*
422	-915 / -249	-4273 / -294	-1726 / -369	-841 / 117	175 / 359	-2341 / 96	1361 / 45	-3687 / 394	-1104 / 275	-3178 / -720	-758 / -466	205 / 210*	-1843 / -626*
423	-1999 / -237	-2374 / -297	-1213 / -372	1564 / 115	1858 / 358	-1945 / 93	-1561 / 44	-2261 / 395	-1621 / 278	-1160 / -718	-1880 / -468	-1739 / 211*	1572 / -627*
436	-3362 / -249	-4044 / -294	-1514 / -369	580 / 117	-635 / 359	-1027 / 96	1765 / 45	-3459 / 394	712 / 275	-166 / -720	-1941 / -466	-1606 / 210*	-3928 / -626*
437	-3302 / -249	-3983 / -294	-1623 / -369	446 / 117	518 / 359	-2060 / 96	-1511 / 45	141 / 394	1208 / 275	-2887 / -720	-1911 / -466	-1553 / 210*	-3859 / -626*

Table 4, Sheet 20/32

Left block (rows 292–306), each cell shows three stacked values (a / b / c):

Row	Col 1	Col 2	Col 3	Col 4	Col 5	Col 6	Col 7
292	2610 / -149 / -2750	-1342 / -500 / -236	-2763 / 232 / -8628	-2644 / 43 / -41	-3503 / -381 / -5171	678 / 401 / -3546	-2484 / 112 / -129
293	136 / -149 / -8	-1631 / -500 / -8080	-1527 / 233 / -9122	-976 / 43 / -894	-1899 / -381 / -1115	-2091 / 399 / -68	-1003 / 106 / -4437
294	-1186 / -149 / -164	-4051 / -500 / -10448	1864 / 233 / -3225	-401 / 43 / -894	-4367 / -381 / -1115	1750 / 399 / -375	1129 / 106 / -2128
295	272 / -149 / -203	-3956 / -500 / -10326	702 / 233 / -2940	2234 / 43 / -894	-4277 / -381 / -1115	227 / 399 / -1827	-2115 / 106 / -478
296	611 / -149 / -2	-2883 / -500 / -10157	-1048 / 233 / -11199	-416 / 43 / -894	-2916 / -381 / -1115	-1167 / 399 / -2297	1492 / 106 / -328
297	801 / -149 / -2	1079 / -500 / -10204	-172 / 233 / -11246	312 / 43 / -894	-880 / -381 / -1115	-3954 / 399 / -1942	-2752 / 106 / -435
298	4 / -149 / -2	-3898 / -500 / -10260	-149 / 233 / -11303	88 / 43 / -894	-4219 / -381 / -1115	-1463 / 399 / -596	-2058 / 106 / -1564
299	-1397 / -149 / -2	-3038 / -500 / -10415	-928 / 233 / -11457	-2901 / 43 / -894	-504 / -381 / -1115	1085 / 399 / -267	-2736 / 106 / -2567
300	-1177 / -149 / -1	-3356 / -500 / -10485	1832 / 233 / -11527	-2532 / 43 / -894	-3429 / -381 / -1115	237 / 399 / -701	-2595 / 106 / -1378
301	1114 / -149 / -60	-4085 / -500 / -10485	594 / 233 / -11527	798 / 43 / -894	-654 / -381 / -1115	-1917 / 399 / -701	-2254 / 106 / -1378
302	-833 / -149 / -2	-4031 / -500 / -10426	173 / 233 / -11468	-1079 / 43 / -894	1188 / -381 / -1115	-1064 / 399 / -294	-2204 / 106 / -2438
303	433 / -149 / -1	-3984 / -500 / -10485	420 / 233 / -11527	767 / 43 / -894	-1222 / -381 / -1115	-3624 / 399 / -701	176 / 106 / -1378
304	328 / -149 / -1	1309 / -500 / -10485	-281 / 233 / -11527	-282 / 43 / -894	-4353 / -381 / -1115	1769 / 399 / -701	1890 / 106 / -1378
305	-1216 / -149 / -1	-4032 / -500 / -10485	-9 / 233 / -11527	-1118 / 43 / -894	-745 / -381 / -1115	942 / 399 / -701	-350 / 106 / -1378
306	-136 / -149 / -1	-3415 / -500 / -10485	-3012 / 233 / -11527	-2457 / 43 / -894	1283 / -381 / -1115	719 / 399 / -701	1555 / 106 / -1378

Right block (rows 438–453), each cell shows two stacked values (top / bottom):

Row	C1	C2	C3	C4	C5	C6	C7	C8	C9	C10	C11	C12	C13
438	-3255 / -627*	-2594 / 210*	-3468 / -467	-2570 / -721	-1940 / 277	1729 / 393	-2326 / 46	-2723 / 95	888 / 359	-1095 / 117	-2280 / -370	-3694 / -295	-3427 / -250
440	-1496 / -626*	-753 / 210*	473 / -466	-976 / -720	-1123 / 275	-2267 / 394	-730 / 45	2059 / 96	773 / 359	1741 / 117	-1268 / -369	-2155 / -294	-1683 / -249
441	-4115 / -626*	-1805 / 210*	-1498 / -466	-531 / -720	719 / 275	-1394 / 394	238 / 45	-2311 / 96	105 / 359	645 / 117	-940 / -369	-4237 / -294	-642 / -249
442	-4027 / -626*	-957 / 210*	-1001 / -466	-3045 / -720	-3 / 275	557 / 394	-604 / 45	-561 / 96	575 / 359	-12 / 117	-3578 / -369	-4139 / -294	-3456 / -249
443	-325 / -626*	-2390 / 210*	448 / -466	-2058 / -720	-2673 / 275	610 / 394	-2278 / 45	25 / 96	-2681 / 359	-266 / 117	512 / -369	2653 / -294	960 / -249
444	341 / -626*	149 / 210*	668 / -466	538 / -720	-3189 / 275	-4017 / 394	593 / 45	-3195 / 96	-416 / 359	-86 / 117	1089 / -369	-3087 / -294	43 / -249
445	-1582 / -626*	892 / 210*	-570 / -466	-2987 / -720	1038 / 275	-689 / 394	819 / 45	2246 / 96	21 / 359	-2365 / 117	-3520 / -369	981 / -294	-288 / -249
446	-1186 / -626*	449 / 210*	263 / -466	-2218 / -720	-3006 / 275	603 / 394	-867 / 45	-554 / 96	39 / 359	187 / 117	1072 / -369	2048 / -294	1040 / -249
447	-1214 / -626*	-833 / 210*	294 / -466	-293 / -720	-727 / 275	-137 / 394	844 / 45	-2813 / 96	-3 / 359	-2659 / 117	548 / -369	952 / -294	2051 / -249
448	-1463 / -626*	282 / 210*	-1404 / -466	452 / -720	-505 / 275	-766 / 394	1139 / 45	-304 / 96	-19 / 359	1081 / 117	-1324 / -369	-4271 / -294	-341 / -249
449	-1235 / -626*	-116 / 210*	-4045 / -466	-3121 / -720	191 / 275	76 / 394	462 / 45	-1170 / 96	-203 / 359	439 / 117	-3650 / -369	963 / -294	3212 / -249
450	-318 / -626*	-1888 / 210*	-905 / -466	-3086 / -720	906 / 275	728 / 394	486 / 45	104 / 96	-2535 / 359	1437 / 117	350 / -369	-4197 / -294	-350 / -249
451	-649 / -626*	-1024 / 210*	-1741 / -466	-3145 / -720	1134 / 275	-3697 / 394	-1811 / 45	-765 / 96	556 / 359	-1304 / 117	-1729 / -369	-4245 / -294	852 / -249
452	-1689 / -626*	82 / 210*	-1244 / -466	-3128 / -720	691 / 275	-136 / 394	-328 / 45	962 / 96	-2518 / 359	133 / 117	148 / -369	1628 / -294	2241 / -249
453	-3109 / -626*	-39 / 210*	-867 / -466	1993 / -720	942 / 275	-900 / 394	-629 / 45	-2757 / 96	458 / 359	350 / 117	-1139 / -369	-3759 / -294	1213 / -249

Table 4, Sheet 21/32

Left	Values (reading order)	Right
307	819/-149 · -1/-10485/-11527 · -4092/-500 · 1457/233 · 1573/43 · -4413/-1115 · -662/399 · 414/106/-1378 · -1864/-626 · -1832/210 · -2123/-466 · -3181/-720 · 760/275 · -1408/394 · 664/45 · -1015/96 · 939/359 · 267/117 · -3714/-369 · -4275/-294 · -3593/-249	454
308	32/-149 · -1/-10485/-11527 · -2705/-500 · -5217/233 · -4581/-894 · -906/-1115 · 41/-701 · -3295/106/-1378 · -1012/-626 · -4178/210 · 1118/-466 · 251/-720 · 1098/275 · -4474/394 · -3801/45 · -3979/96 · 460/359 · -356/117 · 1357/-369 · 2000/-294 · 1529/-249	455
309	142/-150 · -1/-10485/-11527 · -4028/-500 · 108/234 · 874/42 · -4348/-382 · -1341/398 · -2192/105/-1378 · -1403/-627 · -611/209 · -2296/-467 · 157/-721 · 1235/277 · 1056/393 · 1352/48 · -2280/95 · 294/360 · 1338/119 · -601/-368 · -4212/-295 · -3531/-245	456
310	-1126/-149 · -1/-10485/-11527 · -2610/-500 · -2963/233 · -495/43 · -5804/-1115 · -267/399 · -2567/106 · -322/-626 · -795/210 · -1373/-466 · 2904/-720 · -622/275 · -3585/394 · -2126/45 · -392/96 · 916/359 · 69/117 · -154/-369 · -3006/-294 · 1234/-249	458
311	-694/-149 · -2/-9894/-10936 · -2235/-500 · -4645/233 · -4015/43 · -2191/-1115 · 1059/104/-3026 · 638/106 · -322/-626 · -795/210 · 1102/-466 · 1518/-720 · -641/275 · -3982/394 · -3272/45 · 851/96 · -1354/359 · 282/117 · 1211/-369 · -2692/-294 · -2347/-249	459
312	-1055/-149 · -2/-9944/-10986 · -2651/-500 · -613/233 · -3810/43 · 3055/-1115 · -617/399/-3026 · -189/106/-1523 · -40/-626 · -357/210 · 532/-466 · 2046/-720 · 142/275 · -1479/394 · -3268/45 · -3551/96 · -537/359 · 249/117 · -2072/-369 · -3096/-294 · -75/-249	460
313	-467/-149 · -2/-10321/-11363 · -4167/-500 · 2491/233 · 1181/43 · -4487/-1115 · -185/399 · -3351/106 · -4239/-626 · -1905/210 · -4183/-466 · -3258/-720 · 1531/275 · -3743/394 · 456/45 · -609/96 · 712/359 · 63/117 · -3789/-369 · -4350/-294 · -3663/-249	461
314	-1259/-149 · -1/-10485/-11527 · -2730/-500 · -148/233 · -4608/43 · 3644/-1115 · -4450/-701 · -3303/106/-1378 · -537/-626 · -4204/210 · -55/-466 · -1932/-720 · -851/275 · -4499/394 · -3826/45 · -4005/96 · -3535/359 · -2845/117 · 1077/-369 · 1010/-294 · 672/-249	462
315	-2622/-149 · -1/-10485/-11527 · -4063/-500 · 1226/233 · -68/43 · -350/-1115 · -1402/399 · 503/106 · -985/-626 · 397/210 · -162/-466 · -3155/-720 · -2242/275 · 1822/394 · -427/45 · 553/96 · 536/359 · 286/117 · -976/-369 · -4254/-294 · 1241/-249	463
316	-2746/-149 · -1/-10485/-11527 · -3224/-500 · 1186/233 · -2730/43 · 185/-1115 · 347/399 · 2505/106/-1378 · -2850/-626 · -2594/210 · 1342/-466 · 93/-720 · 441/275 · -4036/394 · -2491/45 · -1349/96 · -1197/359 · -6/117 · -2691/-369 · -3603/-294 · 1960/-249	464
317	-203/-149 · -1/-10485/-11527 · -3318/-500 · -3142/233 · -2584/43 · 2102/-1115 · -381/399 · 1857/106/-1378 · -1378/-626 · -11/210 · -870/-466 · 526/-720 · 951/275 · -3981/394 · 863/45 · 548/96 · -279/359 · -780/117 · -1647/-369 · 833/-294 · 1040/-249	465
318	-216/-149 · -1/-10485/-11527 · -4079/-500 · 1226/233 · -6/43 · 883/-1115 · 984/399 · -2256/106 · -1835/-626 · 141/210 · -1227/-466 · -19/-720 · -2234/275 · -136/394 · 269/45 · 384/96 · -215/359 · 438/117 · -3697/-369 · -4266/-294 · 588/-249	466
319	388/-149 · -1/-10485/-11527 · -3951/-500 · 165/233 · -986/43 · 573/-1115 · -3634/399 · -246/106/-1378 · 1134/-626 · 885/210 · -125/-466 · -3056/-720 · -396/275 · -3725/394 · 158/45 · -758/96 · -9/359 · 727/117 · 662/-369 · -4172/-294 · -1068/-249	467
320	346/-149 · -1/-10485/-11527 · 551/-500 · 529/233 · -2498/43 · -181/-1115 · 207/399 · 603/106 · 1285/-626 · -574/210 · 1197/-466 · -542/-720 · -1146/275 · -3947/394 · 232/45 · 341/96 · -1167/359 · -2655/117 · -2869/-369 · -3732/-294 · 493/-249	468
321	-41/-149 · -1/-10485/-11527 · -4088/-500 · -2468/233 · -4/43 · -4408/-1115 · 111/399 · 1186/106/-1378 · -1261/-626 · 400/210 · -2211/-466 · -237/-720 · 732/275 · -883/394 · 1891/45 · 1097/96 · -102/359 · -291/117 · -1544/-369 · -4273/-294 · 1406/-249	469

Table 4, Sheet 22/32

ID	−149	−500	233	43	−381	399	106	−626	210	−466	−720	275	394	45	96	359	117	−369	−294	−249	ID
322	507	−4092	449	641	−4414	575	44	−4164	1050	−4108	−3181	1550	546	−720	−205	534	−202	−1228	−4276	−3593	470
323	1505	−2743	−4902	−1789	1303	−1982	−3231	−70	−3946	275	−1944	−363	129	−1121	−3855	20	400	1440	−3195	−283	471
324	−1181	−3995	572	−1044	2076	58	605	−1596	57	−562	−3095	−2274	−3713	478	213	1242	−1331	509	−4205	−1010	472
325	54	−3258	916	−1144	−3561	794	−1470	532	−168	−1378	−2352	55	−2902	791	1381	518	−666	322	−3452	−2781	473
326	−1841	−2600	−1835	−2154	−4644	1586	−2893	−4556	−3135	−4654	−3836	2243	3218	−2685	−3520	−1961	−2222	−3536	−4706	−4269	474
327	−1431	891	−42	1025	456	1017	−1064	−2967	−646	−2914	−1989	2083	−2498	1034	692	218	−1370	−2520	−3084	−2402	476
328	−355	−1974	−2372	−1796	2376	−2890	−1625	−1567	1866	−1854	1506	675	−2961	−1491	383	−1881	−1570	1115	−2366	−1940	477
329	−1797	−2342	−415	287	2146	−1027	−1712	−51	−142	−441	−1509	−1885	−3066	709	−1954	−458	155	−585	3483	743	478
330	176	−3702	−92	−245	−920	−1338	−1891	146	745	−1033	−231	832	−3324	1918	751	425	−935	−626	−3891	12	479
331	−2358	−2946	488	−965	−3010	1948	775	−389	−803	672	921	−883	−3613	−2003	−2483	−296	−51	−1063	773	1369	480
332	−225	−3817	367	−10	−624	1049	412	−814	1051	−3829	−2908	1912	−3434	−1544	−2091	14	446	5	−4005	−591	481
333	−2215	−3689	592	−269	−4010	−257	−1848	−3760	469	−56	−2778	781	1787	−206	−283	1184	857	−3311	−3872	−3189	482
334	−1053	451	−173	368	985	−582	−1891	623	−1580	−3052	−2247	−1944	−988	2031	471	86	−2075	−1017	2776	1210	483
335	−2120	−3592	1872	−676	−3913	−343	−1752	−3664	159	−823	613	947	−3187	752	658	1133	969	−3214	−3776	−3093	484
336	−796	−2121	−552	−63	−2376	−1691	−301	−2144	1349	−2097	−1233	2085	−1798	2049	−91	−685	−720	−1755	−2222	1482	485

Table 4, Sheet 23/32

Table 4, Sheet 24/32

Primary data rows (top value / column label shown in header):

Index	-149	-500	233	43	-381	399	106	-626*	210*	-466*	275	-720	394	45	96	359	117	-369	-294	-249	Index
337	997	-1241	-578	-133	-1517	-1399	-332	-1234	-83	-1405	1518	-619	-1603	-5	-515	1020	-399	-944	1722	1779	486
338	-813	-1193	-2517	-2345	-1917	-1837	-1987	1819	-2146	-1614	-1892	-1167	-2390	-2008	-2230	2830	-1076	-631	-2498	-2045	487
339	-927	2366	1639	-228	-2602	-1871	-568	-2325	861	-2315	-531	-1422	-1988	1344	-650	-823	1925	-1917	-2518	-1861	488
340	1374	-2592	-5077	-4443	-124	-1761	-3175	-215	-4045	926	-659	3415	-1379	-3673	15	-988	-784	-456	1250	-2707	489
341	669	-4072	-1127	-1928	-4384	267	-2258	64	1359	-759	775	-3164	-1426	250	1455	313	-2560	-1811	-4261	1229	490
342	-60	-4092	1793	555	-4413	-721	591	-4164	866	-942	766	-3181	-3686	1529	137	-1018	189	-3714	415	58	491
343	-2877	521	-228	-4579	1897	-1418	-3294	630	-1972	2065	-4067	336	-1693	-1394	-3978	-1988	-1133	-260	984	733	492
344	1114	-3970	600	-1986	-1332	-3628	-2293	-3951	1865	-1722	1176	14	-3720	-798	-921	-102	-163	500	-4186	1177	493
345	152	-4092	1011	793	-4413	428	44	-1477	194	-2362	1669	-3181	-3686	1065	-2339	509	905	-2008	-4275	-3593	494
346	-218	-2875	-4193	-3609	-142	-1211	-323	115	-123	-219	279	2818	-949	-1143	504	97	-293	-61	2641	338	495
347	71	-2705	-5213	-4578	495	657	-3294	1948	-1135	616	-4067	1591	-1693	-3799	-1274	-1209	587	-343	990	585	496
348	388	-4039	1017	598	-4360	-547	971	-1236	-306	-1981	1250	871	108	791	-1067	631	642	-3661	-4222	-3539	497
349	-1398	-4039	1347	-135	-4360	1020	1623	-1212	777	-371	55	-3128	-3633	489	-321	861	-557	-3661	-4222	379	498
350	-2724	-3331	-141	-323	272	-574	-2612	-786	-1221	-688	-1323	1421	-3974	125	-182	-1029	643	802	4091	546	499
351	623	-3456	-2964	-82	-57	615	-2532	245	-308	327	-572	533	-3911	2001	-57	-1306	-932	-531	-3791	661	500

Secondary rows (leading values; column labels for this sub-row include -894, -1115, -701, -1378):

Index	-149	-500	233
338	-17	-6997	-8039
339	-13	-7341	-8383
340	-8	-8030	-9072
341	-2	-10357	-11399
342	-1	-10485	-11527
343	-1	-10485	-11527
344	-1	-10485	-11527
345	-1	-10485	-11527
346	-1	-10485	-11527
347	-1	-10485	-11527
348	-1	-10485	-11466
349	-2	-10423	-11466
350	-2	-10423	-11466
351	-1	-10485	-11527

Table 4, Sheet 25/32

Each data row is labelled at the left (352–366) and at the right (501–517). For columns 1–7 each cell holds three stacked values (top / middle / bottom); for columns 8–20 each cell holds two stacked values (top / bottom), with "*" marking columns 8 and 9.

Left	C1	C2	C3	C4	C5	C6	C7	C8	C9	C10	C11	C12	C13	C14	C15	C16	C17	C18	C19	C20	Right
352	-156/-149/-1	-4088/-500/-10485	25/233/-11527	301/43/-894	1032/-381/-1115	748/399/-701	486/106/-1378	-4157/-626*	319/210*	-991/-466	690/-720	-11/275	-3687/394	-39/45	-1267/96	1019/359	341/117	-3709/-369	258/-294	879/-249	501
353	386/-149/-1	-4061/-500/-10485	421/233/-11527	-302/43/-894	231/-381/-1115	438/399/-701	-2261/106/-1378	-4109/-626*	188/210*	-549/-466	1388/-720	60/275	-3694/394	-71/45	552/96	426/359	-337/117	-783/-369	1504/-294	789/-249	502
354	-879/-149/-1	1409/-500/-10485	-4984/233/-11527	-1583/43/-894	-578/-381/-1115	-465/399/-701	1302/106/-1378	-627/-626*	-886/210*	449/-466	1708/-720	-3959/275	1019/394	-3674/45	-391/96	-214/359	-226/117	-420/-369	139/-294	2373/-249	503
355	-1603/-149/-1	-4071/-500/-10485	789/233/-11527	-90/43/-894	-4392/-381/-1115	-438/399/-701	525/106/-1378	-4142/-626*	-667/210*	-4087/-466	1182/-720	151/275	2162/394	-213/45	-573/96	1170/359	360/117	-1328/-369	353/-294	-654/-249	504
356	164/-148/-1	-4006/-501/-10485	1385/232/-11527	874/42/-894	-4327/-382/-1115	15/398/-701	930/105/-1768	-4077/-627*	-92/211*	-633/-467	-3095/-721	1912/276	-795/395	-668/51	-2253/95	633/359	-2472/120	-3628/-370	-4189/-295	918/-250	505
357	1136/-149/-1	-3077/-500/-11527	193/233/-894	959/43/-1115	-16/-381/-701	-502/399/-1234	-1254/105/-860	-3138/-627*	-838/210*	-3090/-466	-2168/-721	-1232/278	-210/393	698/45	362/96	-1502/359	1125/117	1299/-370	-3264/-280	-2585/-250	507
358	-701/-149/-1	-3609/-500/-10485	1115/233/-11527	-1443/43/-894	-88/-381/-1115	-14/399/-701	299/106/-1378	-1392/-626*	895/210*	-3624/-466	-2699/-720	1357/275	799/394	704/45	-164/96	-915/359	153/117	837/-369	-3794/-294	-3113/-249	509
359	-1231/-149/-2	884/-500/-9922	947/233/-11527	1343/43/-894	1375/-381/-1115	199/399/-1613	-1959/106/-4227	-1477/-626*	-501/210*	-939/-466	-2788/-720	-729/275	-3388/394	932/45	-61/96	-647/359	-291/117	-1379/-369	1301/-294	949/-249	510
360	-422/-149/-2	-4082/-500/-10112	-177/233/-11527	-744/43/-894	-4399/-381/-1115	-3596/399/-701	812/106/-1378	-1474/-626*	1670/210*	-1007/-466	-3172/-720	1163/275	-3689/394	-635/45	940/96	-409/359	-349/117	259/-369	3343/-294	-879/-249	511
361	2063/-149/-1	-3835/-500/-10485	-284/233/-11527	-2073/43/-894	-4049/-381/-1115	-3672/399/-701	-2345/106/-1378	-3729/-626*	-1980/210*	256/-466	1615/-720	1147/275	-3762/394	1155/45	-721/96	539/359	-297/117	-1175/-369	-4086/-294	-3475/-249	512
362	-83/-149/-1	-2706/-500/-10485	-5208/233/-11527	-4573/43/-894	1133/-381/-1115	57/399/-701	-3293/106/-1378	500/-626*	-4171/210*	-12/-466	480/-720	508/275	-4473/394	-3797/45	-1508/96	-985/359	358/117	2404/-369	-3163/-294	-2821/-249	513
363	-2922/-149/-1	-2751/-500/-10485	-5249/233/-11527	-4619/43/-894	-2714/-381/-1115	-4471/399/-701	-3353/106/-1378	366/-626*	-4221/210*	-66/-466	-1957/-720	1891/275	-4523/394	-3850/45	-4031/96	-463/359	2587/117	1278/-369	2337/-294	-2881/-249	514
364	-6591/-149/-1	-5749/-500/-10485	-7397/233/-11527	-7594/43/-894	3911/-381/-1115	-7189/399/-701	-3596/106/-1378	-5428/-626*	-7161/210*	426/-466	-4871/-720	-5931/275	-7055/394	-729/45	-6595/96	-6411/359	-6467/117	69/-369	2012/-294	1759/-249	515
365	-1388/-149/-1	-3732/-500/-10485	-6389/233/-11527	-5783/43/-894	-175/-381/-1115	-5697/399/-701	-4594/106/-1378	1828/-626*	-5425/210*	1541/-466	186/-720	-5350/275	-5603/394	-4940/45	-5204/96	-4820/359	-3937/117	2430/-369	2295/-294	-3993/-249	516
366	-1199/-149/-1	728/-500/-10485	2819/233/-11527	1540/43/-894	-4376/-381/-1115	1163/399/-701	-2266/106/-1378	-1160/-626*	-1852/210*	-4079/-466	-3161/-720	-230/275	-3698/394	-1810/45	-909/96	-1034/359	-1084/117	-1474/-369	-4260/-294	-3585/-249	517

367 =	-3525	-4145	-6117	-6472	-6811	-4397	-6004	-6617	-6593	-6893	-5938	3991	-5207	-6045	-6340	1494	-990	-1177	-7031	-6952	518
	-149	-500	233	43	-381	399	106	-626	210	-466	-720	275	394	45	96	359	117	-369	-294	-249	
	-1	-10485	-11527	-894	-1115	-701	-1378	*													
368	-8351	-7039	-8010	-8359	-4914	-7245	5446	-8380	-8236	-7682	-7739	-7788	-7602	-7853	-7738	-8455	-8411	-8363	437	-4466	519
	-149	-500	233	43	-381	399	106	-626	210	-466	-720	275	394	45	96	359	117	-369	-294	-249	
	-1	-10485	-11527	-894	-1115	-701	-1378	*													
369	5713	-7209	4171	-1139	-7691	-5309	-4876	-7880	-5377	-7635	-7175	-4028	-5899	-4617	-6337	-5333	-5830	-7322	-7358	-6716	520
	-149	-500	233	43	-381	399	106	-626	210	-466	-720	275	394	45	96	359	117	-369	-294	-249	
	-1	-10485	-11527	-894	-1115	-701	-1378	*													
370	-2724	-3336	-3119	-2562	-3404	-1240	-2610	-941	-2438	-1922	2315	1570	-1231	2033	-868	-637	2484	-1128	-3694	-3212	521
	-149	-500	233	43	-381	399	106	-626	210	-466	-720	275	394	45	96	359	117	-369	-294	-249	
	-36	-10485	-5377	-894	-1115	-701	-1378	*													
371	-192	-4062	-600	735	-4383	533	-2221	-4133	-171	-4078	1177	830	1627	1762	-623	64	-2528	-849	-4245	550	522
	-149	-500	233	43	-381	399	106	-626	210	-466	-720	275	394	45	96	359	117	-369	-294	-249	
	-125	-10450	-3599	-894	-1115	-1420	-675	*													
372	-1141	-3709	-4623	-4041	-4379	-4271	-3670	-3967	-3223	-4210	265	-3864	529	-3489	3785	-1709	105	-3678	-4619	-118	523
	-149	-500	233	43	-381	399	106	-626	210	-466	-720	275	394	45	96	359	117	-369	-294	-249	
	-1658	-10326	-551	-894	-1115	-2638	-253	*													
373	82	-2585	-1301	254	-2969	1681	-1268	1213	-960	-2739	-1898	2254	-2584	-871	-1448	403	-1457	-2290	-3024	-2414	524
	-149	-500	233	43	-381	401	105	-626	210	-466	-721	275	394	45	96	359	117	-369	-295	-250	
	-1076	-2568	-1486	-91	-4030	-5056	-44	*													
374	-1367	-2757	-684	762	-3061	-2109	3698	-2796	-450	-2756	-1901	-755	-2306	1644	-881	-1230	1816	-2389	-2927	-2269	526
	-149	-500	233	43	-381	399	106	-626	210	-466	-720	275	394	45	96	359	117	-369	-294	-249	
	-8	-8039	-9081	-894	-1115	-4127	-85	*													
375	1394	-1810	-3140	-2842	1387	2255	-2607	-2887	-2712	-3150	-2360	-2340	1262	-2491	-2885	894	-1555	-2316	-3527	-3183	527
	-149	-500	233	43	-381	399	106	-626	210	-466	-720	275	394	45	96	359	117	-369	-294	-249	
	-7	-8232	-9274	-894	-1115	-3538	-130	*													
376	849	-1609	-3510	-3089	-1549	1636	-2112	-1290	-2796	2090	-970	-2625	-3110	-2498	-2731	-2012	-1618	-1193	-2101	1259	528
	-150	-501	232	44	-382	401	105	-627	214	-467	-721	274	393	48	97	358	116	-370	-295	-250	
	-1693	-536	-9575	-26	-5789	-2879	-211	*													
377	-226	-3139	1871	1010	-3451	1305	-1240	-3212	-871	-3152	-2238	1334	134	921	-1397	81	-1585	-2757	-3321	-2616	530
	-149	-500	233	43	-381	399	106	-626	210	-466	-720	275	394	45	96	359	117	-369	-294	-249	
	-4	-8935	-9977	-894	-1115	-86	-4118	*													
378	-809	-2678	397	-4494	2346	529	-3251	1288	-4103	-791	89	-897	-4434	-3738	-3925	880	-2783	1385	-3135	-2791	531
	-149	-500	233	43	-381	399	106	-626	210	-466	-720	275	394	45	96	359	117	-369	-294	-249	
	-2	-10447	-11489	-894	-1115	-369	-2148	*													
379	562	-3868	-462	-775	-69	-236	-422	-464	-709	1303	473	-855	-1549	127	-937	83	468	-107	-4111	-249	532
	-149	-500	233	43	-381	399	106	-626	210	-466	-720	275	394	45	96	359	117	-369	-294	-249	
	-1	-10485	-11527	-894	-1115	-701	-1378	*													
380	-743	-3979	-1125	-92	-111	-3625	-2289	-874	-1891	-3974	-3082	-613	-987	1020	-679	1753	2083	394	850	-3542	533
	-149	-500	233	43	-381	399	106	-626	210	-466	-720	275	394	45	96	359	117	-369	-294	-249	
	-1	-10485	-11527	-894	-1115	-701	-1378	*													
381	-962	658	-514	224	10	-4134	1018	-475	-3061	495	-333	-3271	-4202	431	2132	-150	-966	738	-3403	395	534
	-149	-500	233	43	-381	399	106	-626	210	-466	-720	275	394	45	96	359	117	-369	-294	-249	
	-1	-10485	-11527	-894	-1115	-701	-1378	*													

Table 4, Sheet 26/32

Top strip (rows 535–575). Each cell is shown as value / index.

Row													
535	-815/-249	377/-294	-2291/-369	1630/117	-3281/359	-3539/96	17/45	-4307/394	762/275	1430/-720	223/-466	-3421/210	-2390/-626
536	561/-249	3597/-294	-3301/-369	-2599/117	755/359	-2512/96	-531/45	-3791/394	-246/275	-2881/-720	-3711/-466	-705/210	-1076/-626
537	-177/-249	353/-294	-1720/-369	-2560/117	-911/359	-59/96	-1802/45	902/394	167/275	725/-720	-1746/-466	785/210	-4124/-626
538	-3531/-249	-4213/-294	-611/-369	229/117	84/359	-1142/96	34/45	-1558/394	1729/275	-3118/-720	-1661/-466	739/210	-1612/-626
539	-3532/-249	-4214/-294	-1484/-369	-2497/117	529/359	1503/96	1007/45	1382/394	312/275	-3120/-720	-4047/-466	967/210	201/-626
540	-2806/-249	-3488/-294	-2925/-369	-55/117	1233/359	474/96	-1008/45	1064/394	849/275	-2393/-720	-1031/-466	-107/210	-3373/-626
541	-2662/-249	-3420/-294	-2848/-369	-1645/117	-1496/359	-1539/96	1497/45	-2559/394	673/275	-2368/-720	-68/-466	-962/210	-3308/-626
542	-1539/-243	-2198/-269	-1600/-375	1175/119	-492/364	-320/90	202/51	560/393	-219/279	-1100/-715	-1999/-471	1436/205	-2015/-632
568	-3620/-250	-3808/-295	-2263/-370	-1074/117	1540/359	-3042/95	-2759/45	-2284/393	-2079/277	-2716/-721	-3599/-466	-3117/212	-3308/-627
570	1075/-249	-2674/-294	396/-369	-1017/117	-974/359	373/96	-277/45	-2156/394	-712/275	1101/-720	-2473/-466	1705/210	-2487/-626
571	3302/-249	2248/-294	-2449/-369	-3036/117	-3353/359	-3598/96	-3165/45	-4225/394	186/275	-2078/-720	986/-466	-3727/210	-2480/-626
572	-2324/-249	-2971/-294	-2443/-369	-1317/117	-1268/359	2615/96	1215/45	-2432/394	-982/275	975/-720	-2815/-466	723/210	-2875/-626
573	-2088/-249	2205/-294	1849/-369	-1321/117	-1382/359	809/96	995/45	-2521/394	-1174/275	-1500/-720	-2303/-466	869/210	640/-626
574	-2361/-249	2000/-294	-2478/-369	-1330/117	-1272/359	1114/96	1191/45	844/394	-1002/275	-1947/-720	-2872/-466	1621/210	659/-626
575	-3297/-249	-3968/-294	-3385/-369	-2286/117	821/359	1116/96	504/45	-3421/394	-1971/275	321/-720	672/-466	1798/210	-3812/-626

Bottom strip (rows 382–396). Values as read (value / index pairs):

Row							
382	268/-149	2114/-500	-4241/233	20/43	1894/-381	-630/399	232/106
	-1	-10485	-11527	-894/-2134	-1115/-253	-701/2389	-1378/-2380
383	-86/-149	-3754/-500	-986/233	-2134/43	-253/-381	2389/399	-2380/106
	-1	-10485	-11527	-894	-1115	-701	-1378
384	237/-149	-4070/-500	1550/233	-54/43	-92/-381	1244/399	-2259/106
	-1	-10485	-11527	-894	-1115	-701	-1378
	-72	-10485	-4386				
385	-63/-149	-4029/-500	2080/233	-1002/43	334/-381	-1340/399	-117/106
	-72	-10485		-894	-1898		
386	-773/-149	-4031/-500	-704/233	-52/43	-4352/-381	698/399	-2190/106
	-2	-10415	-881	-10415	-451	-1898	
387	741/-149	-3304/-500	1598/233	-1134/43	-3623/-381	-614/399	-1467/106
	-1176	-9537	-847	-64	-4520	-1115	
388	-1675/-149	-3241/-500	2685/233	911/43	-3524/-381	547/399	-1205/106
	-893	-8368	-1126	-41	-5157	-1115	
389	1055/-151	-1975/-505	-432/234	972/40	-2289/-386	-1557/407	-243/100
	-2651	-632	-2354	-132	-4314	-1115	
390	3077/-147	-1244/-500	-3035/232	-3163/45	-3572/-381	-1512/398	-2789/105
	-2640	-257	-8518	-44	-5048	-1115	
391	837/-149	-2471/-500	292/233	1046/43	-2759/-381	-2064/399	-726/106
	-6	-8461	-257	-248	-2662	-42	
392	-3113/-149	-2830/-500	1818/233	-4013/43	1528/-381	-4239/399	-1573/106
	-6	-8461	-9503	-894	-5129	-3497	-134
393	1024/-149	-2812/-500	841/233	-685/43	-3146/-381	-2343/399	-968/106
	-5	-8715	-9758	-894	-5040	-2440	-45
394	-1389/-149	-2365/-500	-1493/233	1183/43	-2536/-381	-2440/399	-1087/106
	-5	-8715	-9758	-894	-3388	-145	
395	-252/-149	-2857/-500	465/233	727/43	-3176/-381	-2365/399	-1023/106
	-4	-8936	-9978	-894	-533	-1694	
396	835/-149	-3773/-500	288/233	-1664/43	-570/-381	-3328/399	-71/106
	-2	-10162	-11204	-894	-608	-1540	

Table 4, Sheet 27/32

Table 4, Sheet 28/32

idx	idx	-149	-500	(x₁)	233	(x₂ / -894)	43	-1115	399	(106)	-626	210	-466	-720	275	394	45	96	359	117	-369	-294	-249
397	576	823	-3170	-2/-10384	-879	-11426/-894	-864	-3221	-1232	-353	1277	-838	530	-193	-665	-3925	-2353	-177	-750	-116	986	-3543	1959
398	577	-2534	-3999	-2/-10384	1738	-11426/-894	-525	-4317	-2206	-1380	-7	2491	-1778	797	-2145	-29	-526	1325	-1394	-495	-3619	-4184	-3503
399	578	-258	-2854	-2/-10384	-4113	-11489/-894	-3531	-2836	-1419	-2148	-1220	-3309	2276	2476	66	-4253	1410	-3454	-795	-758	-2284	-3287	-2908
400	579	2748	75	-2/-10447	-1809	-11489/-894	-4507	-2673	1064	-1378	-415	-4122	585	-1920	-4034	-4466	-750	-3952	-3496	-2818	-566	-3175	-681
401	580	1007	-2722	-1/-10485	-5068	-11527/-894	-4442	-260	-922	-1378	-1143	-4070	417	924	1587	-4454	-862	-171	-6	-794	-314	1884	2319
402	581	2091	-2826	-1/-10485	-4410	-11527/-894	-350	-2798	-765	-1378	886	-1305	-185	571	-1268	-4343	-3320	-3627	-142	257	1282	-3267	-2900
403	582	-316	-2736	-1/-10485	-5254	-11527/-894	-4620	2973	-4458	-1378	833	-4215	1354	-1929	-4102	-4507	-3835	-4014	-1749	-2851	505	890	1656
404	583	-2877	-2707	-1/-10485	-5197	-11527/-894	-688	-2661	-4422	-1378	2104	-4164	1293	2607	-4060	-4472	1015	-3972	-762	653	-558	870	-503
405	584	-102	-249	-1/-10485	-5221	-11527/-894	-4585	1419	-4427	-1378	-67	-4181	2348	1741	-1301	-4477	-259	-3983	-3512	-2821	-1289	-3164	-2822
406	585	1121	-2789	-1/-10485	-4966	-11527/-894	-4359	-2774	272	-1378	-1241	-4015	817	573	-3967	-4463	-3694	-1461	860	2532	-2226	-3266	-2918
407	586	-1162	504	-1/-10485	-5204	-11527/-894	-4569	278	-1169	-1378	-705	-4168	978	1453	-1329	-4472	-3794	1338	1072	-2817	-857	2168	578
408	587	-197	-4091	-1/-10485	834	-590/-894	483	-4411	-3593	-1378	-1792	-929	-1839	-3180	-524	2750	-56	1482	-663	-287	-1727	-4274	-3592
409	588	108	-1882	-1579/-10485	-2115	-9952/-894	-1557	277	1324	-5632	-1493	-1415	-235	-1061	540	-2792	356	-1750	116	-1418	-1344	-2264	2967
410	589	-1283	-4239	-4/-8910	-1531	-9952/-894	-5491	-6763	3626	-346	-6578	-6019	-6793	-5871	-4794	-5195	-5548	-437	-1285	-4041	-1415	-6951	-6754
411	590	-611	-2728	-1/-10485	-5019	-11527/-894	-4396	-875	-4395	-1378	1500	-4034	-2578	475	966	-4447	-712	-1081	19	2168	1067	647	877

Idx	C1	C2	C3	C4	C5	C6	C7	C8	C9	C10	C11	C12	C13	C14	C15	C16	C17	C18	C19	C20	Idx
412	-463 / -149 / -1	-3750 / -500 / -10485	-5545 / 233 / -11527	-5211 / 43 / -894	-4778 / -381 / -1115	-1375 / 399 / -701	-4650 / 106 / -1378	-4375 / -626 / *	-1470 / 210 / *	-1705 / -466	-3960 / -720	-4554 / 275	3885 / 394	-4708 / 45	-5002 / 96	-885 / 359	-483 / 117	-587 / -369	-5170 / -294	-4852 / -249	591
413	-406 / -149 / -1	2352 / -500 / -10485	-733 / 233 / -11527	-3127 / 43 / -894	323 / -381 / -1115	-4097 / 399 / -701	-2866 / 106 / -1378	504 / -626 / *	-467 / 210 / *	159 / -466	-2214 / -720	-493 / 275	-1071 / 394	794 / 45	174 / 96	-46 / 359	-1390 / 117	1009 / -369	-3440 / -294	1877 / -249	592
414	-4702 / -149 / -1	-4203 / -500 / -10485	-7370 / 233 / -11527	-7027 / 43 / -894	262 / -381 / -1115	-7166 / 399 / -701	-7004 / 106 / -1378	3284 / -626 / *	-6962 / 210 / *	-3594 / -466	268 / -720	-6819 / 275	-6917 / 394	-6860 / 45	-7081 / 96	-6511 / 359	232 / 117	2105 / -369	-6428 / -294	-5951 / -249	593
415	-7127 / -149 / -1	-6045 / -500 / -10485	-7502 / 233 / -11527	-7856 / 43 / -894	2309 / -381 / -1115	-7386 / 399 / -701	-309 / 106 / -1378	-6013 / -626 / *	-7401 / 210 / *	-5320 / -466	1996 / -720	-5995 / 275	-7240 / 394	-538 / 45	-6768 / 96	-6634 / 359	-6976 / 117	-6169 / -369	-2816 / -294	4339 / -249	594
416	-1722 / -149 / -1	-4302 / -500 / -10485	-3604 / 233 / -11527	-3359 / 43 / -894	-4183 / -381 / -1115	-1214 / 399 / -701	-3510 / 106 / -1378	-4733 / -626 / *	-3410 / 210 / *	-4822 / -466	-4070 / -720	-46 / 275	-4701 / 394	1972 / 45	-3807 / 96	1462 / 359	-3584 / 117	-4336 / -369	1026 / -294	3906 / -249	595
417	-1586 / -149 / -1	-4606 / -500 / -10485	633 / 233 / -11527	-4189 / 43 / -894	-6820 / -381 / -1115	3298 / 399 / -701	-4973 / 106 / -1378	-6677 / -626 / *	-5288 / 210 / *	-6784 / -466	-5927 / -720	-4169 / 275	-38 / 394	-4749 / 45	-53 / 96	525 / 359	-4212 / 117	-5576 / -369	-6941 / -294	-6442 / -249	596
418	-2645 / -149 / -1	-4116 / -500 / -10485	2070 / 233 / -11527	1526 / 43 / -894	-1241 / -381 / -1115	-3611 / 399 / -701	1940 / 106 / -1378	-4185 / -626 / *	-1860 / 210 / *	-4131 / -466	-3206 / -720	-2247 / 275	-65 / 394	1591 / 45	-747 / 96	-2525 / 359	1067 / 117	-3737 / -369	-4300 / -294	1627 / -249	597
419	-2625 / -149 / -1	-4031 / -500 / -10485	-1060 / 233 / -11527	3238 / 43 / -894	-618 / -381 / -1115	-1292 / 399 / -701	-2271 / 106 / -1378	-4056 / -626 / *	-681 / 210 / *	-1825 / -466	1023 / -720	-542 / 275	-3702 / 394	-1821 / 45	-265 / 96	-1370 / 359	-1030 / 117	-1215 / -369	-4231 / -294	-936 / -249	598
420	-1034 / -149 / -1	-2720 / -500 / -10485	-5079 / 233 / -11527	-1279 / 43 / -894	1571 / -381 / -1115	-1417 / 399 / -701	58 / 106 / -1378	1638 / -626 / *	-4078 / 210 / *	-417 / -466	905 / -720	-844 / 275	-4456 / 394	2001 / 45	-3927 / 96	-491 / 359	-2813 / 117	-331 / -369	2033 / -294	1810 / -249	599
421	-2907 / -149 / -50	-4290 / -500 / -10485	618 / 233 / -11527	-962 / 43 / -894	-4563 / -381 / -1115	2854 / 399 / -701	664 / 106 / -1378	-4291 / -626 / *	-2183 / 210 / *	-1667 / -466	-3405 / -720	-2448 / 275	-1378 / 394	-2104 / 45	-2699 / 96	49 / 359	404 / 117	-3889 / -369	-4504 / -294	1570 / -249	600
422	-474 / -149 / -2	598 / -500 / -10485	-1486 / 233 / -11527	-1922 / 43 / -894	308 / -381 / -1115	-114 / 399 / -701	-3056 / 106 / -1378	-1113 / -626 / *	-3495 / 210 / *	-4 / -466	3600 / -720	-1012 / 275	-4294 / 394	413 / 45	445 / 96	-1247 / 359	-830 / 117	-1236 / -369	2604 / -294	382 / -249	601
423	238 / -149 / -125	-4087 / -500 / -11479	1128 / 233 / -11527	-891 / 43 / -894	-4406 / -381 / -1115	-367 / 399 / -328	177 / 106 / -2299	-1155 / -626 / *	-238 / 210 / *	-2200 / -466	-225 / -720	301 / 275	111 / 394	-579 / 45	-2341 / 96	744 / 359	2247 / 117	-1726 / -369	-4272 / -294	-3591 / -249	602
424	-1091 / -149 / -2	-3993 / -500 / -10362	833 / 233 / -11404	-617 / 43 / -894	75 / -381 / -1115	2430 / 399 / -2391	-131 / 106 / -305	-4063 / -626 / *	-51 / 210 / *	-4009 / -466	-3083 / -720	1846 / 275	-3587 / 394	-162 / 45	-2243 / 96	-2402 / 359	-424 / 117	-3615 / -369	-4177 / -294	638 / -249	603
425	-376 / -149 / -30	-3984 / -500 / -10437	1222 / 233 / -11527	-100 / 43 / -894	601 / -381 / -1115	1631 / 399 / -2391	-153 / 106 / -2299	-4054 / -626 / *	326 / 210 / *	-4000 / -466	-3073 / -720	48 / 275	-566 / 394	613 / 45	-2233 / 96	-580 / 359	-473 / 117	500 / -369	-4168 / -294	393 / -249	604
426	127 / -149 / -1169	-3961 / -500 / -10334	870 / 233 / -851	-877 / 43 / -894	-4283 / -381 / -1115	489 / 399 / -2590	-166 / 106 / -262	-4033 / -626 / -5680	1214 / 210 / *	-3977 / -466	113 / -720	1373 / 275	475 / 394	-558 / 45	533 / 96	-106 / 359	-314 / 117	-3583 / -369	1977 / -294	258 / -249	605

Table 4, Sheet 29/32

427	-459 -149 -408	-1653 -500 -9169	-3572 233 -2033	-408 43 -894	1776 -381 -1115	1540 399 -3333	-2061 106 -151
428	-1483 -149 -309	-2965 -500 -8946	465 233 -2391	1104 43 -894	-3283 -381 -1115	736 399 -4938	-1106 106 -48
429	-1303 -149 -1363	1409 -501 -713	1871 233 -9685	-648 44 -784	-2928 -378 -1254	-2279 400 -4263	-929 104 -77
430	-1378 -148 -3892	-1464 -501 -196	1505 233 -4066	-149 47 -18	-1448 -382 -6308	-383 405 -4205	-1564 104 -80
431	-1247 -149 -5	-2712 -500 -8729	176 233 -9771	907 43 -894	-3030 -381 -1115	460 399 -997	-881 106 -1003
432	-1003 -149 -2	-2598 -500 -9851	3026 233 -10893	-2324 43 -894	-66 -381 -1115	-1180 399 -2650	-2211 106 -250
433	-4259 -149 -2578	-6085 -500 -9938	168 233 -266	-389 43 -894	-6338 -381 -1115	-1353 399 -3963	-3437 106 -96
434	-767 -150 -2537	-1577 -502 -712	-1043 232 -2204	-1067 42 -2592	-3143 -383 -262	1519 400 -5349	-1529 112 -36
435	-516 -149 -2189	-984 -500 -746	-1115 233 -2440	-725 43 -82	-1277 -378 -4184	-1618 398 -3801	-728 105 -107
436	-842 -149 -2587	-1512 -500 -268	-1081 232 -8465	-942 43 -46	-2142 -377 -4987	956 398 -434	-1175 110 -1945
437	667 -149 -2	22 -500 -10119	2713 233 -11161	-265 43 -894	492 -381 -1115	-1542 399 -2057	-1977 106 -397
438	163 -149 -2	2158 -500 -10192	-139 233 -11234	334 43 -894	-3981 -381 -1115	-1132 399 -2369	428 106 -311
439	-2407 -149 -2	3398 -500 -10227	-136 233 -11269	1040 43 -894	-4126 -381 -1115	-1288 399 -2362	-2049 106 -312
440	-191 -149 -2	1100 -500 -10255	-2291 233 -11297	1293 43 -894	-977 -381 -1115	303 399 -3026	-2067 106 -189
441	458 -149 -186	1520 -500 -10255	-130 233 -3060	-1724 43 -894	-4201 -381 -1115	839 399 -1934	-2056 106 -438

	863 -249	-2101 -294	773 -369	-1675 117	-256 359	-2642 96	-294 45	-708 394	-2687 275	970 -720	-1506 -466	-2665 210*	1132 -626
606	863 -249	-2101 -294	773 -369	-1675 117	-256 359	-2642 96	-294 45	-708 394	-2687 275	970 -720	-1506 -466	-2665 210*	1132 -626
607	-2458 -249	-3148 -294	-2586 -369	1160 117	452 359	-1217 96	-650 45	689 394	1862 275	-2058 -720	-2980 -466	263 210*	-3037 -626
608	-2204 -251	3918 -296	-2248 -369	-1240 117	834 358	967 94	-489 47	-2373 394	-940 277	-1750 -722	-2635 -468	778 212*	-2639 -628
612	-1511 -251	1890 -296	496 -369	-1319 122	-1790 359	-2009 94	-1651 44	191 392	-2001 276	-656 -722	353 -467	-1845 209*	2094 -628
614	-2217 -249	-2898 -294	972 -369	-1186 117	1202 359	651 96	649 45	-2315 394	-858 275	930 -720	-2727 -466	772 210*	-2778 -626
615	1948 -249	-2990 -294	-2055 -369	-552 117	-2445 359	-2508 96	33 45	1008 394	-2452 275	-1775 -720	-1281 -466	-2179 210*	-860 -626
616	-5251 -249	-6158 -294	-5704 -369	-4304 117	-3918 359	443 96	-3099 45	3905 394	-2764 275	-5374 -720	-6026 -466	-1184 210*	-6205 -626
617	-2736 -252	-3243 -297	-2164 -362	1385 118	-873 358	-1831 93	-1234 43	-2118 394	3091 278	-2184 -723	-3025 -468	-1441 209*	-2894 -623
627	-1201 -250	-1662 -295	-304 -370	1361 117	-734 359	-925 96	-536 45	-1864 394	2411 277	-403 -721	-1043 -466	-611 210*	1389 -624
629	-1909 -250	-2412 -295	-1484 -370	-987 117	-970 360	-1362 95	-939 45	-2133 395	2383 277	3596 -721	-2033 -466	-1029 210*	-1815 -627
631	750 -249	-3874 -294	-3252 -369	-2257 117	-912 359	-2078 96	-320 45	-3404 394	766 275	-2762 -720	-705 -466	-345 210*	-915 -626
632	-3284 -249	-3932 -294	312 -369	-946 117	214 359	-2142 96	59 45	-3467 394	2472 275	-2818 -720	-1918 -466	-1645 210*	691 -626
633	-448 -249	-4023 -294	-3437 -369	-976 117	-1148 359	2733 96	-62 45	-3481 394	-2032 275	-2922 -720	-267 -466	-1638 210*	-3861 -626
634	-712 -249	-4045 -294	-1038 -369	700 117	-213 359	540 96	486 45	-3499 394	291 275	-2944 -720	-3856 -466	786 210*	945 -626
635	-3390 -249	-4070 -294	-3504 -369	410 117	683 359	606 96	-122 45	-187 394	449 275	1209 -720	54 -466	280 210*	-3948 -626

Table 4, Sheet 30/32

Table 4, Sheet 31/32

Each cell below lists the stacked values (top/middle/bottom) exactly as printed. An asterisk (*) marks the bottom value where the source shows "*".

Row	C1	C2	C3	C4	C5	C6	C7	C8	C9	C10	C11	C12	C13	C14	C15	C16	C17	C18	C19	C20
636 / 442	-848/-149/-2	-3504/-500/-10119	1165/233/-11162	-27/43/-894	589/-381/-1115	-713/399/-3527	-2036/106/-131	-1675/210/*	-749/-626/*	-434/-466	2480/-720	2087/275	-3452/394	-1624/45	-577/96	196/359	365/117	-3065/-369	-3759/-294	-3152/-249
637 / 443	189/-149/-2	-3751/-500/-11162	-781/233/-11264	227/43/-894	-4059/-381/-1115	-151/399/-3527	-1947/106/-527	-1532/210/*	-1353/-626/*	-3762/-466	1222/-720	908/275	1881/394	683/45	871/96	-1188/359	-1039/117	-1510/-369	2049/-294	1195/-249
638 / 444	-54/-149/-2	-2472/-500/-10119	-1427/233/-11162	-4321/43/-894	1165/-381/-1115	248/399/-1708	-3054/106/-671	-3923/210/*	-952/-626/*	18/-466	1178/-720	-3820/275	-823/394	-908/45	-3734/96	-3268/359	33/117	-515/-369	4459/-294	1654/-249
639 / 445	-818/-149/-2	-3941/-500/-10222	624/233/-11264	13/43/-894	779/-381/-1115	-979/399/-1427	-146/106/-671	967/210/*	-1114/-626/*	-1627/-466	-3030/-720	1286/275	-1468/394	599/45	716/96	1074/359	-503/117	-723/-369	-4124/-294	-3442/-249
640 / 446	-50/-149/-2	2734/-500/-10311	1602/233/-4899	985/43/-894	-1033/-381/-1115	170/399/-2734	424/106/-235	-1827/210/*	-1653/-626/*	-3541/-466	-2706/-720	-2203/275	275/394	-1774/45	-488/96	-369/359	-2401/117	-1049/-369	1707/-294	227/-249
641 / 447	-1344/-149/-2	-3417/-500/-10262	267/233/-11304	1427/43/-894	889/-381/-1115	-3595/399/-2217	-2287/106/-350	-113/210/*	749/-626/*	-505/-466	855/-720	-506/275	-3681/394	-585/45	-2447/96	-520/359	832/117	-1416/-369	-3725/-294	2123/-249
642 / 448	497/-149/-2	-3964/-500/-10289	-282/233/-11331	-89/43/-894	28/-381/-1115	-3465/399/-1655	2394/106/-551	896/210/*	-4035/-626/*	-3980/-466	-3053/-720	1233/275	744/394	1063/45	609/96	-1403/359	-812/117	-804/-369	-4147/-294	670/-249
643 / 449	446/-149/-2	-3864/-500/-10337	535/233/-3698	716/43/-894	-4185/-381/-1115	-1034/399/-2571	-2025/106/-266	913/210/*	-1451/-626/*	-292/-466	-235/-720	-738/275	-3460/394	1106/45	1382/96	-483/359	982/117	-3486/-369	-4048/-294	-640/-249
644 / 450	-618/-149/-3	-3458/-509/-1525	2309/242/-2132	892/49/-894	-3776/-387/-1115	-61/396/-3170	-1599/105/-170	-283/214/*	-3530/-633/*	-3473/-473	-2550/-701	1526/274	-3027/385	-1143/42	698/94	602/360	739/125	-3079/-378	-3640/-261	-2951/-244
659 / 451	-159/-149/-2	-1691/-500/-1480	-3708/233/-2132	-3099/43/-894	1577/-381/-1115	-3286/399/-3750	-2133/106/-111	715/210/*	-73/-626/*	120/-466	910/-720	-2784/275	-3340/394	-2483/45	-488/96	1106/359	1793/117	-78/-369	-2141/-294	-1787/-249
660 / 452	246/-149/-4	1159/-500/-9234	372/233/-10276	1702/43/-894	318/-381/-1115	-2656/399/-1318	-1318/106/-1019	-914/210/*	-3058/-626/*	-648/-466	512/-720	994/275	-26/394	-871/45	477/96	-444/359	700/117	-2651/-369	-3255/-294	-2595/-249
661 / 453	-1069/-149/-3	-2335/-500/-9312	-4412/233/-11056	1/43/-894	26/-381/-1115	-3947/399/-981	-2797/106/-1019	41/210/*	183/-626/*	1807/-466	224/-720	-3463/275	-4001/394	-710/45	-3406/96	-1428/359	-885/117	-1752/-369	2785/-294	402/-249
662 / 454	277/-149/-2	-3251/-500/-10014	-2499/233/-2891	-1946/43/-894	1305/-381/-1115	-1730/399/-2224	1022/106/-347	824/210/*	590/-626/*	-1777/-466	-2394/-720	-2198/275	-1131/394	140/45	1402/96	-451/359	-2290/117	-2769/-369	-3560/-294	2663/-249
663 / 455	-950/-149/-210	-3858/-500/-10101	39/233/-11256	480/43/-894	-4178/-381/-1115	-1336/399/-524	-267/106/-1716	612/210/*	-277/-626/*	-244/-466	-4/-720	227/275	37/394	2036/45	179/96	175/359	205/117	-383/-369	-4041/-294	-3359/-249
664 / 456	728/-149/-2	-3966/-500/-10214	-624/233/-11399	909/43/-894	812/-381/-1115	-1165/399/-932	597/106/-1071	105/210/*	-542/-626/*	-358/-466	-3057/-720	-137/275	-831/394	1711/45	170/96	-2393/359	-962/117	-527/-369	-4154/-294	853/-249

Additional trailing line printed below row 456:
-2, -10357, -11399, -894, -1115, -2427, -297

#	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	#
457	66 / -149 / -2	-2591 / -500 / -10357	-5105 / 233 / -11399	-4470 / 43 / -894	-188 / -381 / -1115	-1573 / 399 / -2427	-3183 / 106 / -297	2992 / -626 / *	-1564 / 210 / *	377 / -466	-1794 / -720	-3956 / 275	-4361 / 394	-3689 / 45	-3867 / 96	-107 / 359	-2705 / 117	805 / -369	-3049 / -294	493 / -249	665
458	771 / -149 / -2	-3980 / -500 / -10357	870 / 233 / -11399	-586 / 43 / -894	-4301 / -381 / -1115	-3482 / 399 / -2427	-2141 / 106 / -297	-250 / -626 / *	2057 / 210 / *	-2375 / -466	-115 / -720	-992 / 275	-830 / 394	1327 / 45	-298 / 96	497 / 359	102 / 117	-3602 / -369	-4164 / -294	-721 / -249	666
459	824 / -149 / -2	-3981 / -500 / -10357	-2356 / 233 / -11399	-648 / 43 / -894	-4302 / -381 / -1115	961 / 399 / -178	-2141 / 106 / -3104	-4052 / -626 / *	1359 / 210 / *	-3997 / -466	-3070 / -720	753 / 275	459 / 394	-578 / 45	667 / 96	926 / 359	246 / 117	-3603 / -369	956 / -294	-564 / -249	667
460	-262 / -149 / -1	504 / -500 / -10485	-5193 / 233 / -11527	-4559 / 43 / -894	-2662 / -381 / -1115	-1787 / 399 / -701	-3291 / 106 / -1378	-193 / -626 / *	-4160 / 210 / *	1812 / -466	2808 / -720	-4058 / 275	-4471 / 394	-44 / 45	1634 / 96	-1315 / 359	-2817 / 117	405 / -369	-3165 / -294	-2822 / -249	668
461	608 / -149 / -1	-3114 / -500 / -10485	1889 / 233 / -11527	-2942 / 43 / -894	-3135 / -381 / -1115	-1460 / 399 / -701	-2791 / 106 / -1378	1522 / -626 / *	-2790 / 210 / *	-416 / -466	-2294 / -720	1311 / 275	-4111 / 394	-449 / 45	-3103 / 96	-610 / 359	-373 / 117	1203 / -369	-3513 / -294	-3084 / -249	669
462	1064 / -149 / -1	-4092 / -500 / -10485	352 / 233 / -11527	-287 / 43 / -894	-4413 / -381 / -1115	692 / 399 / -701	1287 / 106 / -1378	-4164 / -626 / *	-609 / 210 / *	-518 / -466	-3181 / -720	810 / 275	565 / 394	-79 / 45	69 / 96	879 / 359	-1440 / 117	-3714 / -369	-4275 / -294	333 / -249	670
463	1044 / -149 / -1	-2707 / -500 / -10485	-5195 / 233 / -11527	-1784 / 43 / -894	2589 / -381 / -1115	-2059 / 399 / -701	-3291 / 106 / -1378	959 / -626 / *	-1193 / 210 / *	1067 / -466	-1910 / -720	-4058 / 275	-4471 / 394	-3790 / 45	-3971 / 96	-646 / 359	-403 / 117	212 / -369	1583 / -294	-2821 / -249	671
464	-5309 / * / *	-5869 / * / *	-6219 / * / *	-1531 / * / *	-6756 / * / *	-5764 / * / *	2106 / * / *	-1505 / * / *	-2098 / * / 0	-5643 / *	8 / *	-4432 / *	-5670 / *	-483 / *	3918 / *	-5184 / *	-4930 / *	-5825 / *	-5467 / *	-5419 / *	672

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